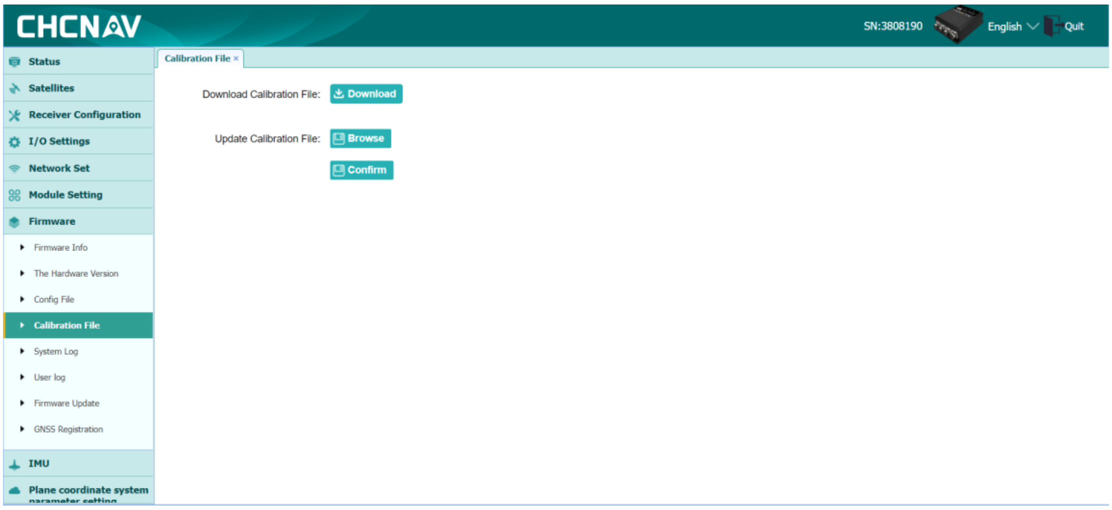
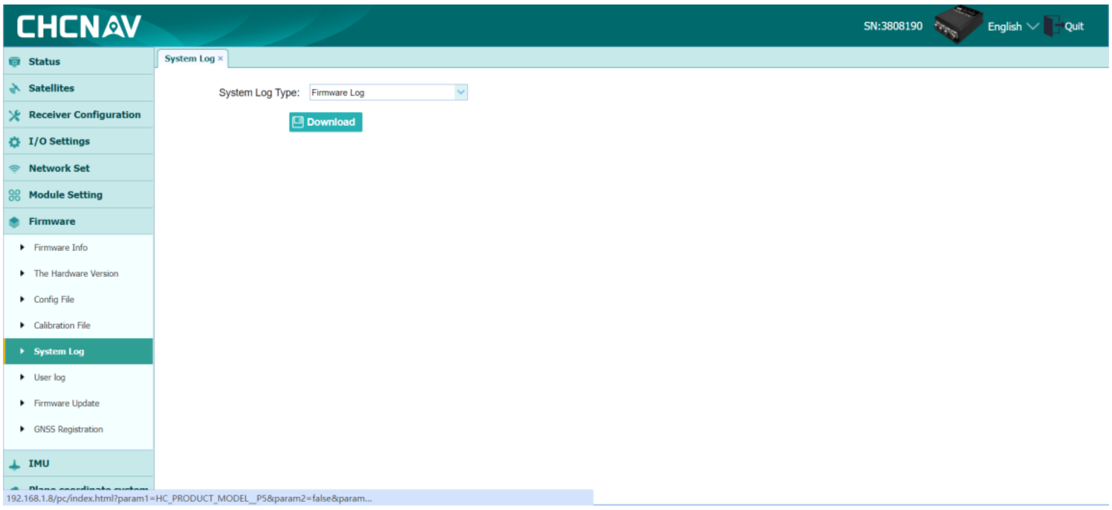


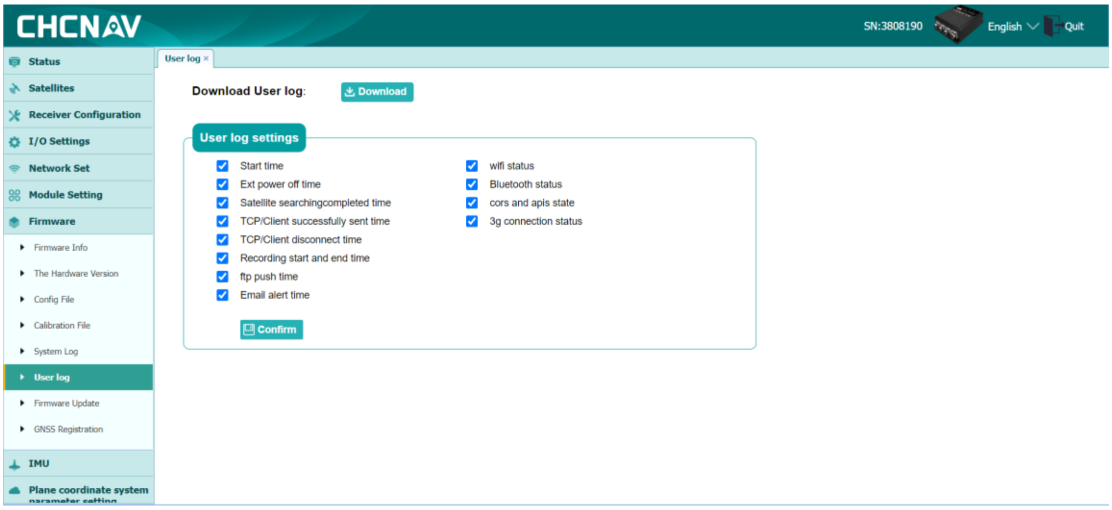
2.7.5 System Log

“System Log” includes a download function for software operation logs, which contains information such as the device's power-on and power-off times. It is suitable for scenarios where you need to analyze the operating status of the device.



2.7.6 User Log

“User Log” includes options for downloading user logs and selecting the content to be downloaded. It is suitable for scenarios where you need to analyze the operating status of the device.



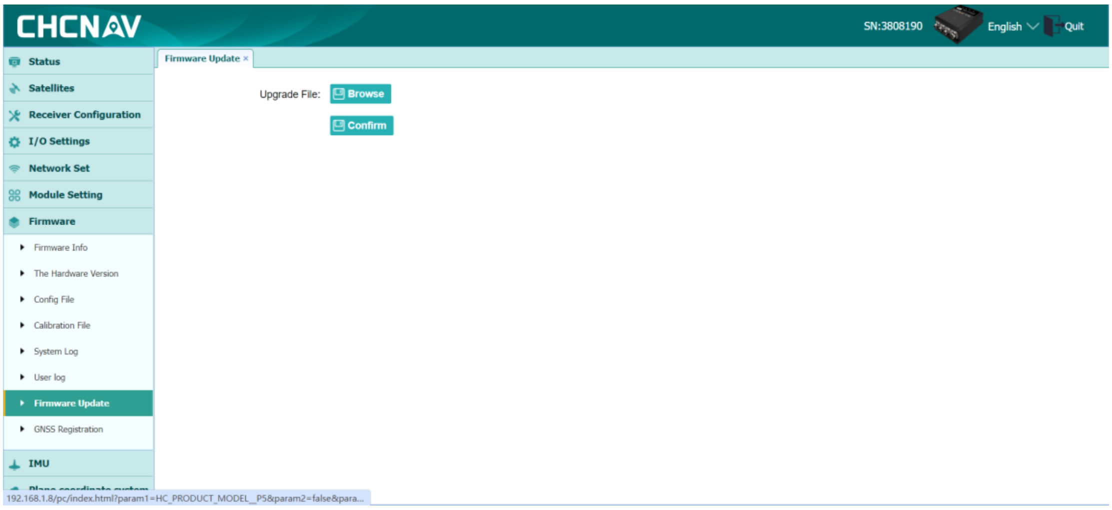
2.7.7 Firmware Update

In “Firmware Upgrade”, click on “Browse”. In the pop-up dialog box, select the local firmware upgrade package and click “Confirm” to start the automatic upgrade. The upgrade is expected to take 3 to 5 minutes. *(Note: please do not power off the device during the upgrade process.)*

Ensure a good Wi-Fi connection between the computer and the device during the upgrade. Once the upgrade is complete, the Wi-Fi connection between the computer and the device will be disconnected. Click to reconnect and refresh the browser page to return to the latest firmware menu.

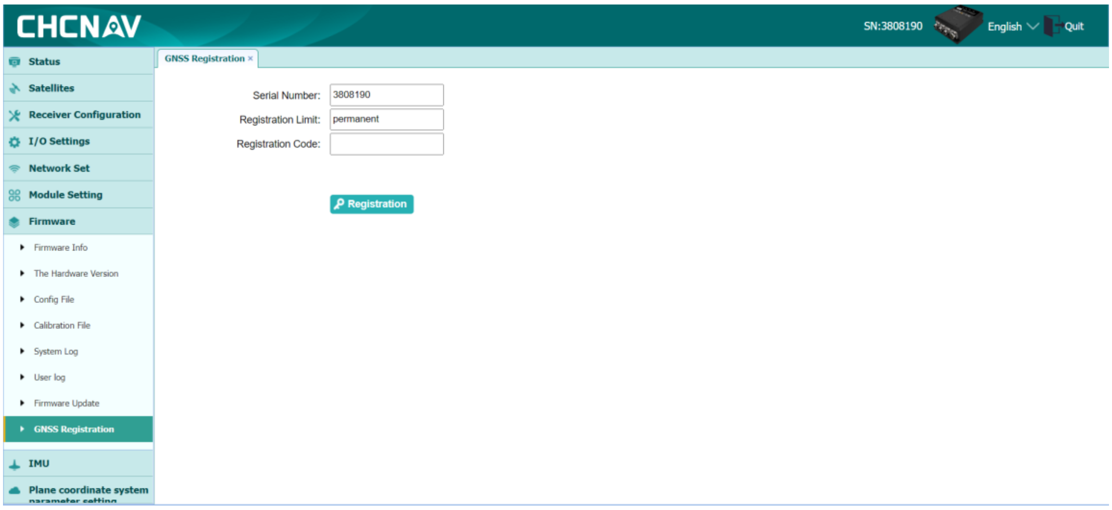
If there is a significant difference in firmware versions before and after the upgrade, clear the browser's image cache data and refresh the device's web page after a successful upgrade to return to the menu page of the latest firmware.

Your original parameter configurations will not be lost after the firmware upgrade. If the device was already in the integrated navigation state before the upgrade, to be on the safe side, you will need to perform a vehicle calibration again after the upgrade to enter the integrated navigation state.



2.7.8 GNSS Registration

Click on “GNSS Registration” and use the registration code provided by the registration software to complete the registration. This will enable the receiver to function normally within the current registration period. If the device registration has expired, a registration expiration prompt will appear after you log in to the device's web page. Enter the registration code and click "OK" to use it normally.

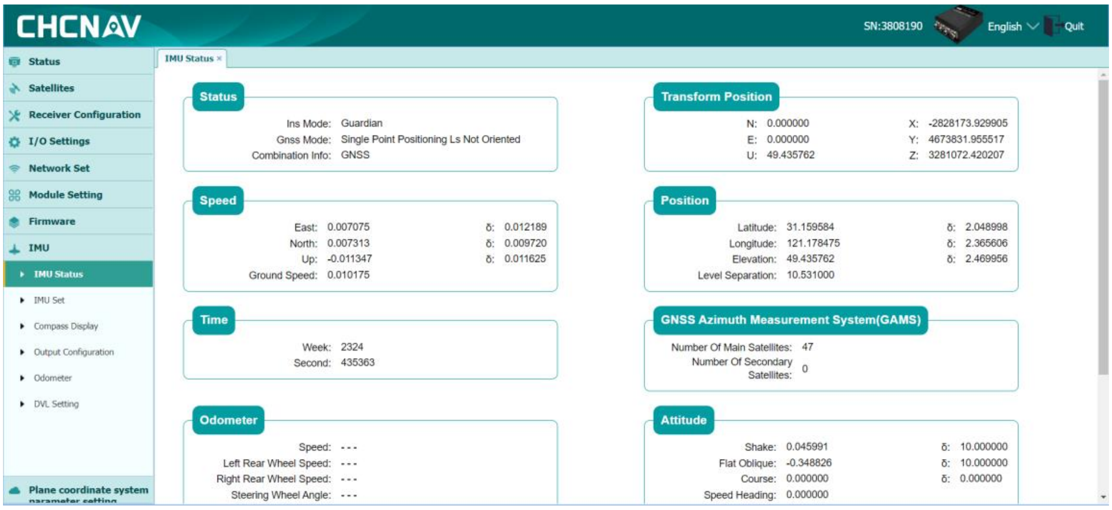


2.8 IMU Interface

The IMU interface includes displays and configurations for inertial navigation status, inertial navigation parameters, compass display, output settings, odometer, and DVL (Doppler Velocity Log) content. It is an interface that must be checked and configured when the device is put into normal use.

2.8.1 IMU Status

By clicking on "IMU Status," you can view the receiver's status, position, speed, transform position, time, attitude, odometer, primary/secondary satellite count, differential age, antenna open/short circuit alarm prompts, calibration progress, and driving status information.



2.8.1.1 Ins Mode

There are four types of states, namely Satellite Navigation, Initialization, Integrated Navigation, and Pure Inertial Navigation.

① The Satellite Navigation state generally occurs when the device has not configured inertial navigation parameters, has configured inertial navigation parameters but has not started the calibration process, has not connected dual antennas, or the real-time combination option is turned off.

② The Initialization state generally occurs when the device has configured inertial navigation parameters and the heading accuracy meets the orientation requirements, is in the calibration process, or the device has not found satellites at startup.

③ The Integrated Navigation state generally occurs when the calibration is complete and the environment is capable of satellite reception.

④ The Pure Inertial Navigation state generally occurs when, after entering the Integrated Navigation mode, the environment is not receiving satellites or the satellite reception is very poor.

2.8.1.2 GNSS Mode

There are ten types of states, namely Non-Positioning and Non-Orientation, Single-Point Positioning without Orientation, Single-Point Positioning with Orientation, Pseudorange Differential Positioning without Orientation, Pseudorange Differential Positioning with Orientation, RTK Floating Solution of Positioning without Orientation, RTK Floating Solution of Positioning with Orientation, RTK Fixed Solution of Positioning without Orientation, RTK Fixed Solution of Positioning with Orientation, Integrated Dead Reckoning.

① Non-Positioning: This indicates that the device is not connected to an antenna or is in an environment where it cannot search for satellites.

② Single-Point Positioning: This means the device has not received differential data. It can achieve a fixed solution by using methods such as inserting a card, connecting to the internet via an Ethernet cable, or supplying differential data through a serial port.

③ Pseudorange Differential Positioning: The device has received differential data, but the satellite signal reception is very poor. This state typically occurs in areas with severe obstructions like under dense tree canopies or under overpasses.

④ RTK Float Positioning: The device has received differential data, but the satellite signal reception is poor. This state usually occurs in areas with obstructions such as tree-lined roads or in the vicinity of tall buildings.

⑤ RTK Fix Positioning: The device has received differential data and has good satellite signal reception. This state is generally observed in open road sections and partially obstructed areas.

⑥ Orientation: The device currently has high heading accuracy, meeting the requirements for orientation. This state is typically achieved when using dual antennas in open areas or with a single antenna during high-speed travel.

⑦ Non-Orientation: The device's heading accuracy is insufficient and does not meet the requirements for orientation. This usually happens when dual antennas are not connected, are connected in reverse, or are in obstructed positions.

⑧ Integrated Dead Reckoning: During system initialization or under integrated navigation mode, if the GNSS antenna fails to receive satellite signals, the navigation system will switch to a pure inertial navigation state. At this point, the GNSS status will indicate this condition.

2.8.1.3 Combination Info

There are five types of states, namely GNSS, GNSS|IMU, GNSS|IMU|Wheel Speed, IMU, IMU|Wheel Speed.

① GNSS: This indicates that the device has not entered the integrated navigation mode.

② GNSS|IMU: This represents that the device has entered the integrated navigation mode and is in the satellite search state.

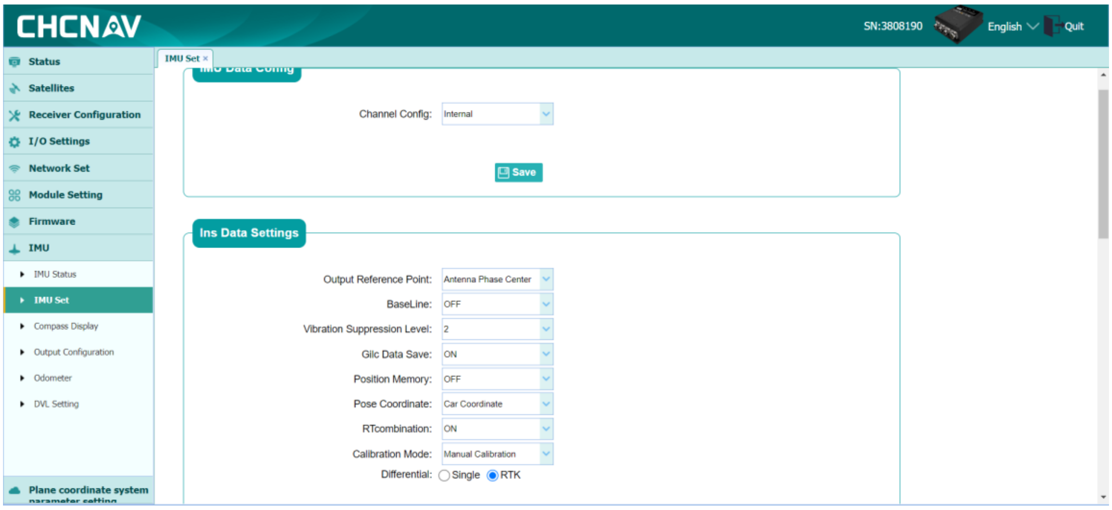
③ GNSS|IMU|Wheel Speed: This means the device has entered the integrated navigation mode with wheel speed data and is in the satellite search state.

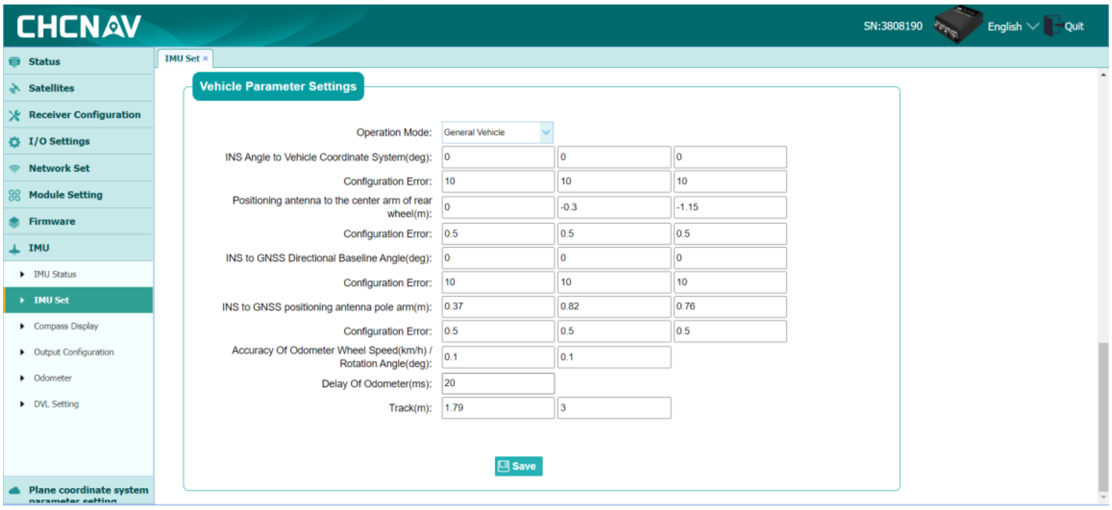
④ IMU: This indicates that the device has entered the integrated navigation mode but is not in the satellite search state.

⑤ IMU|Wheel Speed: This signifies that the device has entered the integrated navigation mode with wheel speed data and is not in the satellite search state.

2.8.2 IMU Set

By clicking "IMU Set" you can configure the necessary parameter information for device calibration, which mainly includes inertial navigation data configuration, fusion data settings, alignment configuration, and vehicle parameter settings. Inertial navigation data configuration has only one option, which is channel configuration, where you can choose to use the built-in IMU or an external IMU. When selecting an external IMU, it is generally used in conjunction with the CI-1250 product as a reference device. Fusion data settings include output reference points, baseline configuration, vibration suppression level, algorithm log saving, position memory, attitude reference system, real-time integration, calibration mode, and differential, among others.





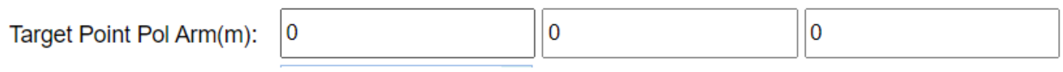
(1) The output reference point is used to set the reference benchmark point for the position and velocity data of all integrated navigation in the composite data output. It can be configured in three modes: IMU position, antenna phase center, and target point.

① IMU Position: The center position of the inertial navigation IMU is used as the reference point for output. This setting takes effect during the initialization and combination states. In the satellite navigation state, all composite data outputs are still based on the position of the positioning antenna phase center. To ensure the accuracy of the data output, in this mode, the measurement accuracy of the distance from the IMU center to the positioning antenna phase center, known as the lever arm, should reach the centimeter level.

② Antenna Phase Center: The phase center of the positioning antenna is used as the reference point for the output of combined data.

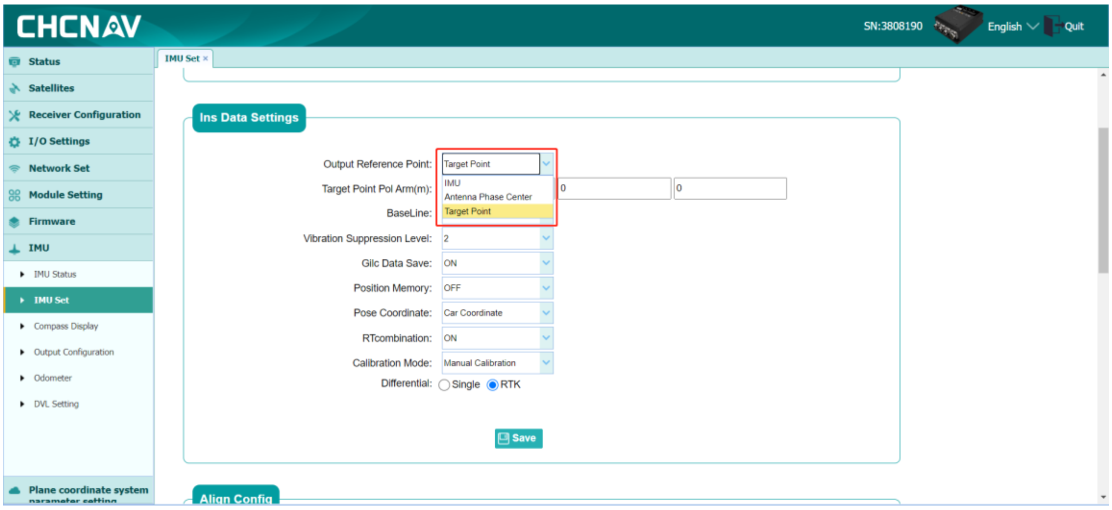
③ Target Point: You can designate any position on the carrier as the reference point for the output of combined data; this setting takes effect during the initialization or integrated navigation state. In the satellite navigation state, all combined data outputs are still based on the phase center position of the positioning antenna.

When this mode is selected, the web page automatically displays the "Target Point Pol Arm" configuration bar.

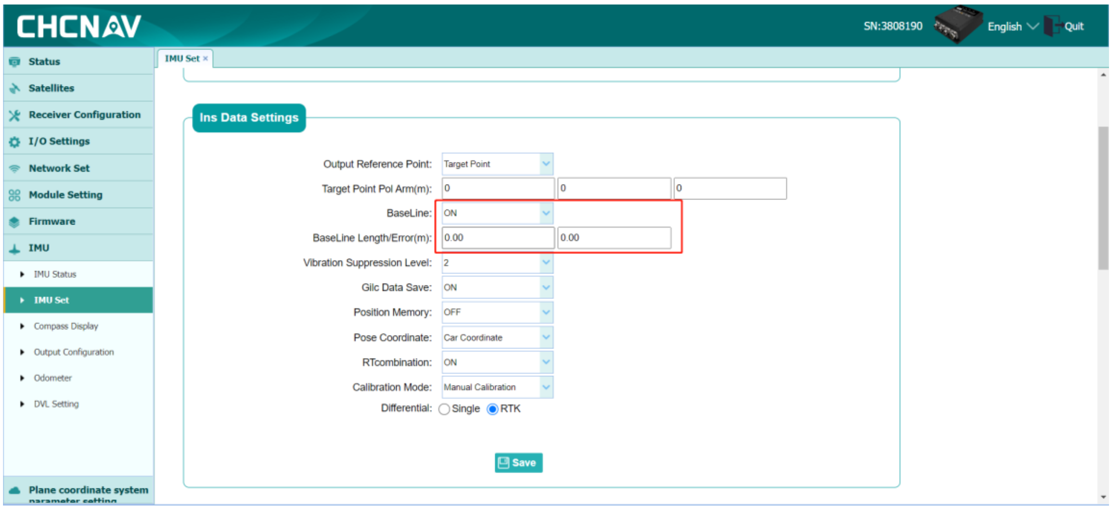


The definition of the target point pol arm is as follows:

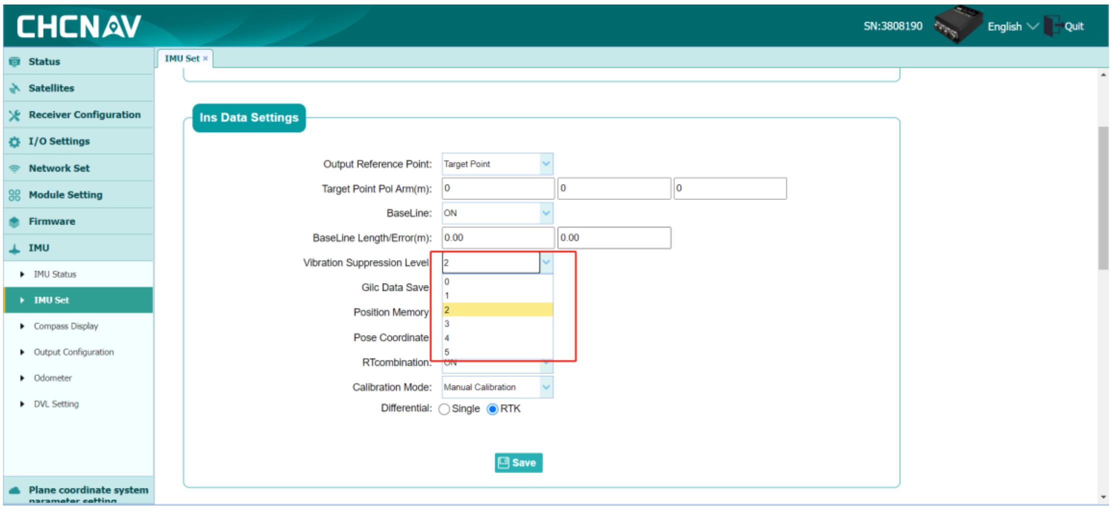
In accordance with the vehicle coordinate system, using the GNSS positioning antenna as the origin, the vector direction points to the position coordinates of the target point. The values are in decimal form, with X, Y, and Z filled in from left to right, in meters; to ensure data accuracy, the measurement precision of the target point lever arm should reach the centimeter level.



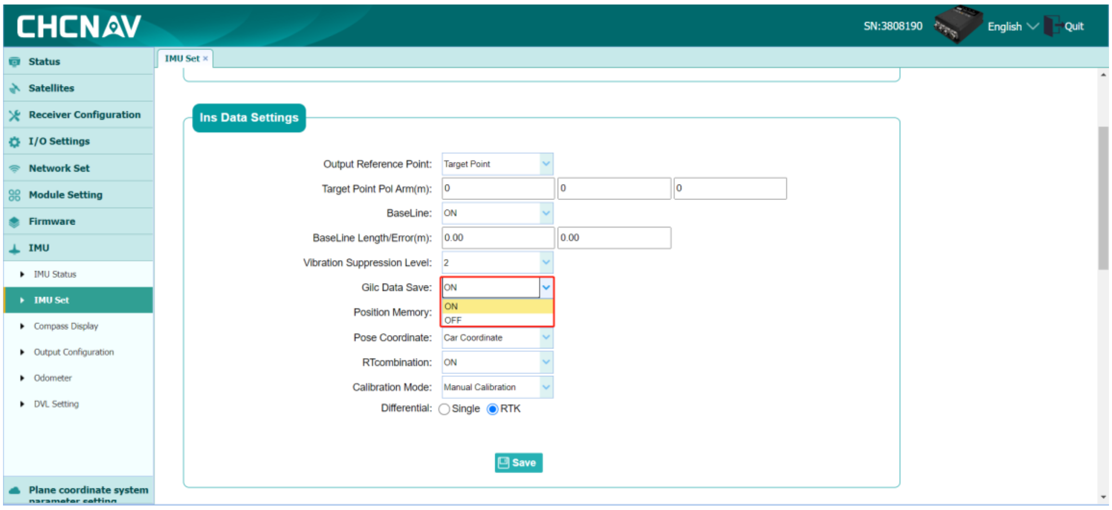
(2) The baseline configuration is set to off by default. When you choose to turn it on, you need to enter the baseline length, which is the straight-line distance between the phase centers of the positioning and directional antennas, with the unit in meters. Since there are systematic errors when measuring the baseline length, you can fill in the error slightly larger than the systematic error, with the unit in meters.



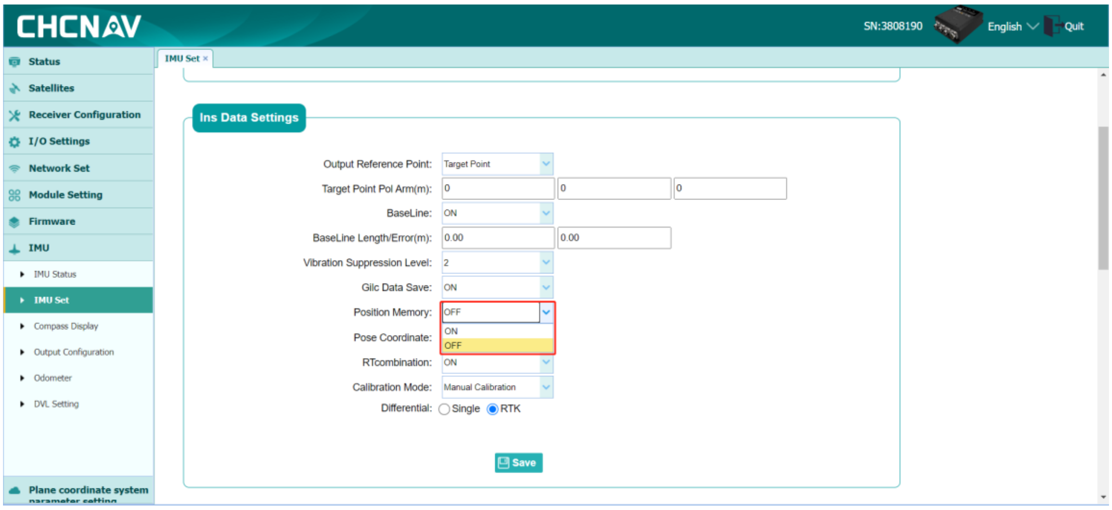
(3) Vibration suppression levels offer six options ranging from 0 to 5. The higher the level selected, the stronger the IMU filter, the greater the noise suppression capability, the weaker the dynamic performance, and the higher the latency. The default level is 2 (40Hz), which is suitable for road and highway vehicles; for low-speed carriers such as mining trucks and construction machinery, the level can be appropriately increased based on the intensity of vibration, with the maximum being 5 (5Hz).



(4) Gilc Data Save has two options: ON and OFF, with the default set to ON. Unless there are special circumstances, please do not choose to OFF this option.

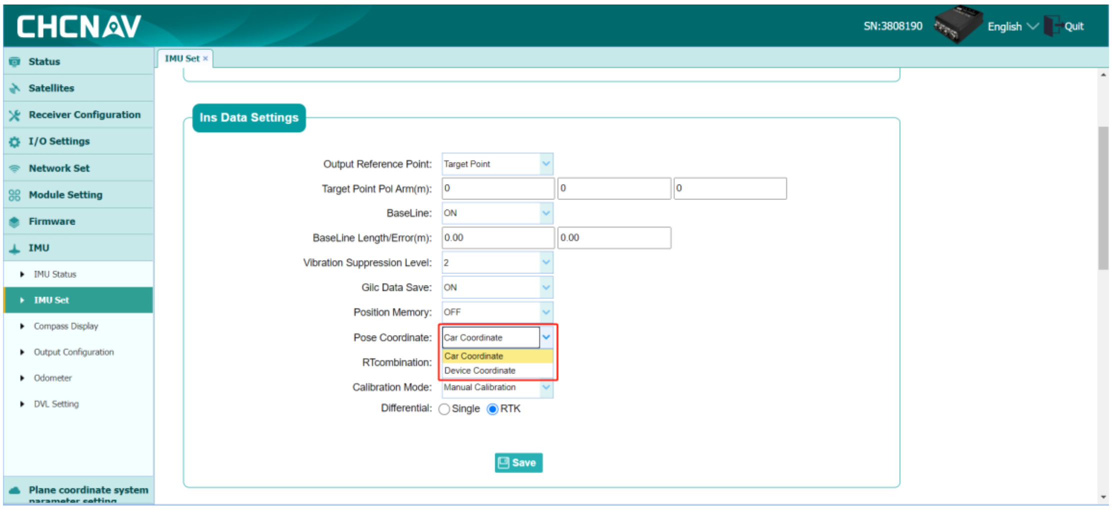


(5) The Position Memory function, when the vehicle will drive into a garage or other scenes with obstructions for parking, when this option is turned on, the device will automatically record the vehicle's parking position, heading attitude, and time information before power off. When the vehicle starts again, it can complete the initial alignment based on the historical position and heading attitude information. Before the vehicle drives out of the obstructed scene where the GNSS antenna can search for stars, it can provide the vehicle's continuous position, velocity, and attitude information through inertial navigation calculation. It should be noted that if there is a garage vehicle movement after the device is powered off, this function is not supported. If there is no need for this, this function can be ignored, and the default is to keep it closed.

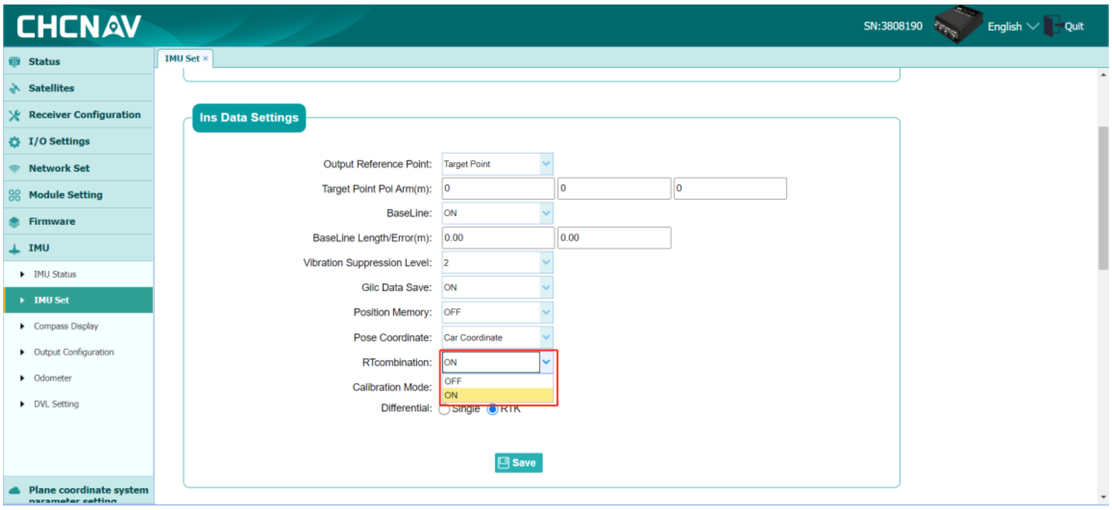


(6) The attitude reference system is only responsible for the transformation of the attitude angles, with the options of car attitude and device attitude, defaulting to the car coordinate

system. Through this configuration, you can switch the reference basis of the attitude data. When the car attitude is selected, the attitude data represents the three-dimensional attitude of the vehicle coordinate system in the navigation coordinate system. When the device attitude is selected, the attitude data represents the three-dimensional attitude of the coordinate system adjusted by the installation angle of the device coordinate system in the navigation coordinate system. This protocol configuration involves all data protocols that include attitude information. It supports the following protocols: INSPVAB/INSPVAXB/INSPVASB/INSPVAXSB/HCINSPVATB/HCINSPVATZCB/GPCHC/CAN/GPCHCX



(7) The RT combination option is turned on by default and can be selected to close, allowing the device to output pure satellite navigation GNSS data. After closing, the internal GNSS/INS fusion function is turned off, and only the RTK algorithm is running, using the device as a pure satellite navigation positioning and orientation GNSS device. Any vehicle parameter configuration will not affect the results of the GNSS data.



(8) The calibration mode can be selected as not calibration or manually calibration, with the default being manually calibrated. The detailed descriptions are as follows:

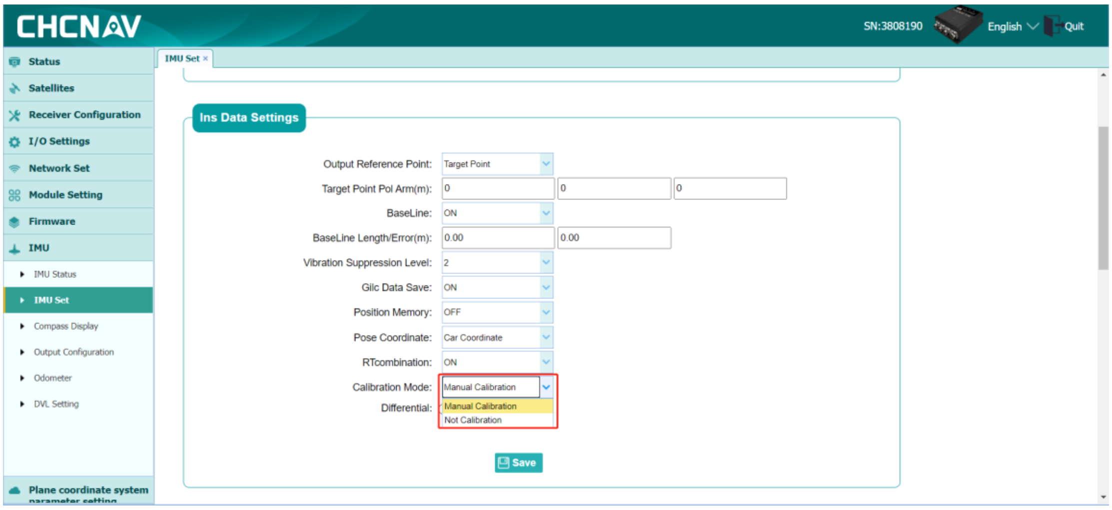
① Not calibration

After the device is installed for the first time, it directly uses the vehicle configuration parameters to align and combine without the need for calibration in an open environment. The algorithm does not estimate or compensate for antenna lever arm errors, device installation angle errors, or directional antenna orientation baseline angle errors. If there are known errors, they need to be compensated by adjusting the vehicle configuration parameters.

This is suitable for low-speed carriers (harbor AGVs - low-speed multi-wheel steering), non-vehicle model carriers (mechanical arms - combined AHRS), and other carrier scenarios where calibration is difficult, and the calibration effect of dual-antenna installation is poor.

② Manually calibration

After the device is installed for the first time or if the installation position (including antenna position and the direction and position of the inertial navigation device) is adjusted, it is necessary to calibrate according to the calibration process requirements. This is to correct for antenna lever arm errors, device installation angle errors, and directional baseline angle errors. (Refer to Section 3.3 for the calibration process)



(9) Differential options can be single-point or RTK. When single-point is selected, it is possible to achieve single-point alignment (initialization) to enter the combination. When RTK is selected, the device must reach a fixed solution before alignment (initialization) can be achieved.

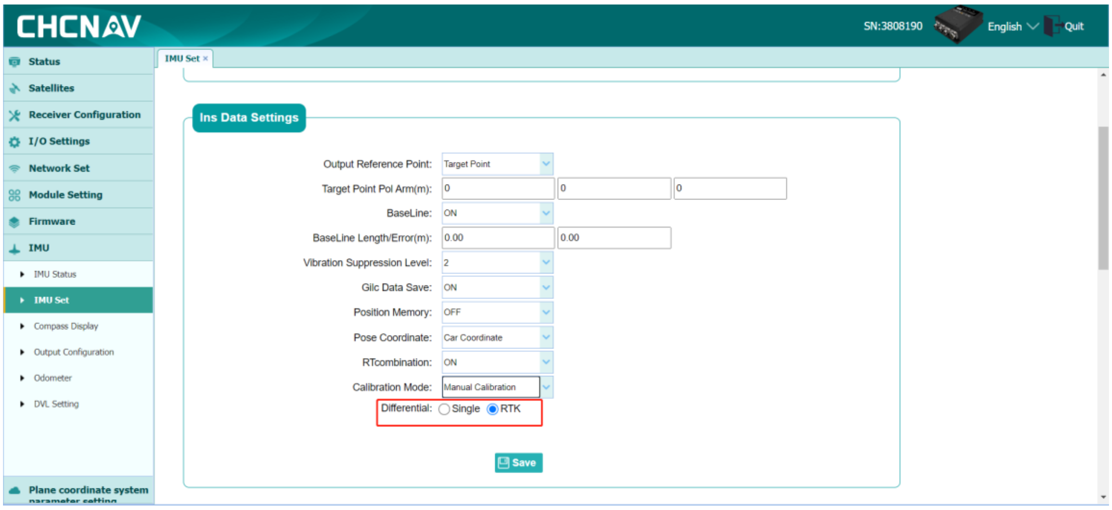
The single-point mode is calibrated as Stable, and the conditions required for successful calibration are as follows:

① In Isingle-antenna mode, a speed of over 15 km/h is required for the device to enter initialization (the calibration speed condition for low-speed vehicle mode is over 0.5 m/s), and this condition is not required in dual-antenna mode;

② Although a fixed solution is not required, the device must have the conditions for satellite search and positioning;

③ The vehicle must have turning and acceleration/deceleration motion during the movement process;

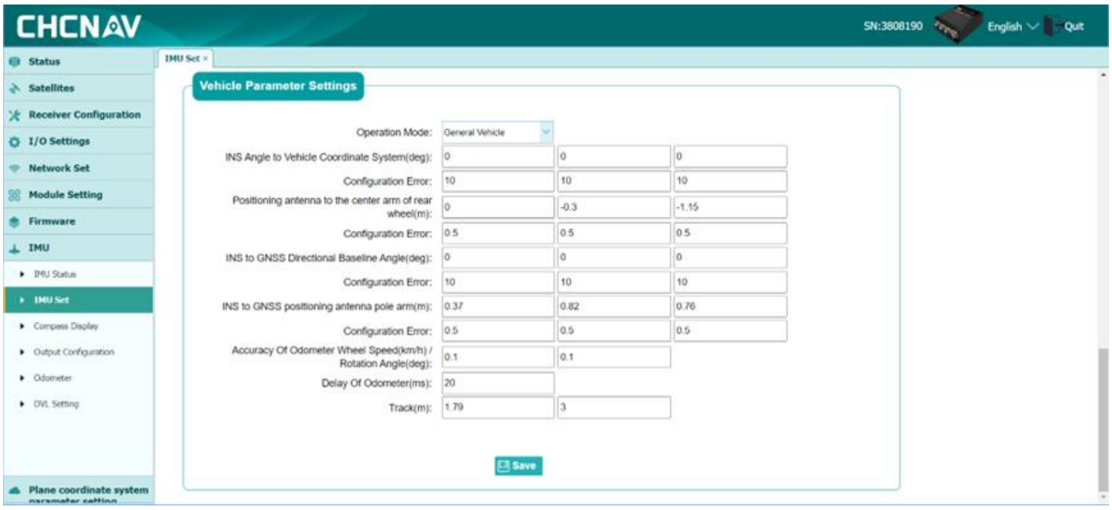
Under the above conditions, the general calibration time is less than 3 minutes.



The alignment configuration section includes settings for the GNSS antenna, alignment mode, alignment position, and initial time. In the GNSS option, selecting a single antenna allows for alignment (initialization) at a certain driving speed with a single antenna, and this mode only supports General Vehicle and Low Speed Car modes. When a dual antenna is selected, dual antennas must be oriented to achieve alignment (initialization), with the default being dual antennas. The alignment mode and alignment position are set to automatic by default, and the initial time is optional.

The alignment mode can be set to automatic, mooring (1, 5, 10, 15 minutes), GNSS speed and heading, and manual heading, with the default being automatic. The alignment position should be set to automatic when the antenna is connected; manual settings are only supported in the absence of an antenna. When the no antenna mode is selected, the alignment mode only supports mooring and manual heading, and an initial time must be entered, with the time format being: 2024-02-29 00:00:00.

The Vehicle Parameter Settings section includes configurations for the working mode, the angle from the inertial navigation system to the vehicle coordinate system, the lever arm from the positioning antenna to the center of the rear wheel, the angle between the GNSS orientation baseline and the vehicle coordinate system, the lever arm from the inertial navigation system to the GNSS positioning antenna, the accuracy/angle precision of the odometer wheel speed, the odometer delay, and the wheelbase configuration.



(9) The working mode is used to distinguish the type of carrier and the kinematic model of the carrier, including General Vehicle, Low Speed Car, Multi Low Speed vehicle, Rail, Combination AHRS (Attitude and Heading Reference System), Ship, USV (Unmanned Surface Vehicle), AUV (Autonomous Underwater Vehicle), ROV (Remotely Operated Vehicle), with the default being the general vehicle mode. The specific meanings are as follows:

① General Vehicle

Suitable for vehicle carriers that normally travel at speeds above 15 km/h, with single front-wheel steering or single rear-wheel steering. In this mode, the algorithm can correct the installation angle error of the GNSS orientation antenna.

② Low Speed Car (<15km/h)

Suitable for low-speed vehicles or robots with normal operating speeds below 15 km/h, featuring single front-wheel steering or single rear-wheel steering.

In this mode, the algorithm does not correct for the installation angle error of the GNSS orientation antenna. If high absolute heading accuracy is required, it is necessary to ensure that the "GNSS orientation baseline angle with the vehicle coordinate system" configuration parameter matches the actual installation angle and is precise when using it.

③ Mult Low Speed (<15km/h)

Suitable for multi-wheel steering vehicles or port AGV flatbed trucks that can move straight and diagonally, with normal operating speeds below 15 km/h. The algorithm can correct the installation angle error of the GNSS orientation antenna.

④ Rail

Suitable for rail-bound vehicle carriers such as trains, high-speed rail, and virtual track vehicles like BRT (Bus Rapid Transit) smart tracks.

⑤ Combination AHRS

Suitable for non-vehicle carriers that require attitude and position, such as robotic arms. In this mode, there is no need for a calibration process after the device is installed, and the algorithm does not correct for the installation angle error of the GNSS orientation antenna.

In this mode, the algorithm does not correct for the installation angle error of the GNSS orientation antenna. If high absolute heading accuracy is required, it is necessary to ensure that the "GNSS orientation baseline angle with the vehicle coordinate system" configuration parameter matches the actual installed angle and is precise when using it.

⑥ Ship

Suitable for ships that are not affected by ocean currents, or are minimally affected by them, such as large cruise ships, cargo ships (in the tonnage class).

⑦ USV

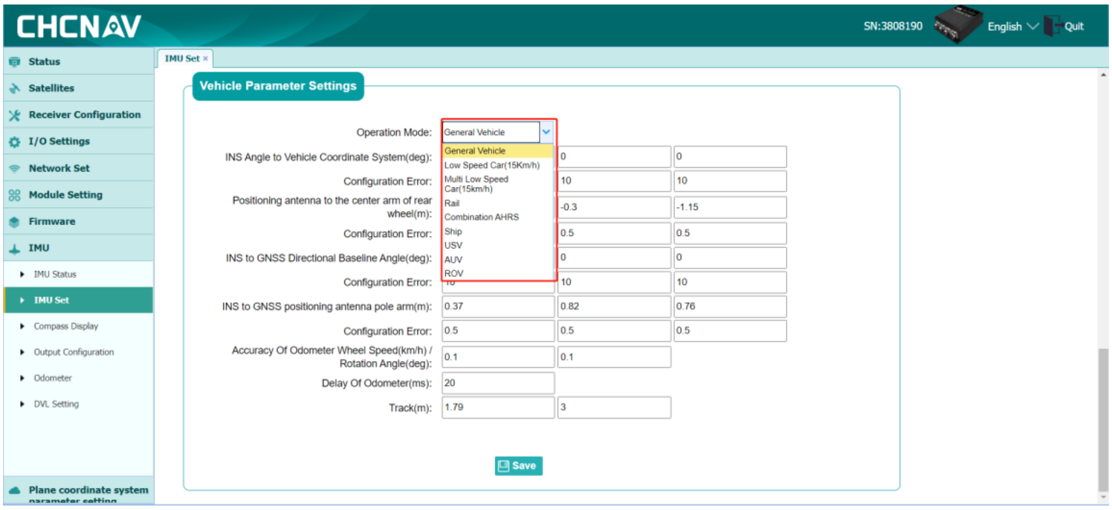
Suitable for unmanned surface vessels, or in conditions with significant ocean currents, such as small boats, unmanned surface vehicles.

⑧ AUV

Suitable for underwater autonomous underwater vehicles without cables, such as Autonomous Underwater Vehicles (AUVs) that are wirelessly connected to the outside world.

⑨ ROV

Suitable for underwater vehicles connected to a mothership with a cable, such as Remotely Operated Vehicles (ROVs) that are connected to the surface with a tether.



(10) The angle from the INS to the vehicle coordinate system

The vehicle coordinate system, according to the right-hand rule, requires three rotation angles to rotate sequentially around the Z, X, and Y axes to the inertial navigation system's installation position/device coordinate system. Decimals, from left to right are X, Y, Z, unit (°).

Configuration Errors:

Angular configuration errors are represented by positive decimal values, corresponding to the X, Y, and Z axes from left to right, with the unit of measurement being degrees (°). The default setting for these errors is 10°.If the configuration error is set to a value less than or equal to 0.1°, the algorithm will cease to adjust for the installation angle discrepancies of the inertial navigation equipment. This implies that the system assumes a high degree of precision in the installation angles, thus negating the need for further correction by the algorithm.

(11) Positioning antenna to the center arm of rear wheel

Within the framework of the vehicle coordinate system, using the positioning antenna as the origin, the vector direction is aimed at the position coordinates of the center of the vehicle's rear axle. The values are in decimal format, listed sequentially from left to right as X, Y, and Z, with the unit of measurement in meters (m).

Configuration Errors:

The lever arm configuration error is specified. Positive decimal values are provided, corresponding to the X, Y, and Z axes from left to right, with the unit of measurement in meters (m). The default value for these errors is set at 0.5 meters. This parameter is critical for accurate positioning and navigation, as it defines the permissible deviation from the idealized configuration of the lever arm in the system's coordinate space.

(12) The angle from the GNSS heading baseline to the vehicle coordinate system

In accordance with the vehicle coordinate system and the right-hand rule, the Y-axis undergoes sequential rotations around the Z, X, and Y axes to align with the orientation baseline direction (the main antenna points towards the auxiliary antenna). The required three rotational angles are expressed as decimals, listed from left to right as X, Y, and Z, with the unit of measurement in degrees (°). For example:

① For a tandem antenna installation with the positioning antenna at the rear and the directional antenna at the front, the input is (0,0,0)

② For a side-by-side antenna installation with the positioning antenna on the left and the directional antenna on the right, the input is (0,0,-90)

③ For a side-by-side antenna installation with the positioning antenna on the right and the directional antenna on the left, the input is (0,0,90)

Configuration Errors:

The configuration error of the directional baseline angle is specified. Positive decimal values are provided, corresponding to the X, Y, and Z axes from left to right, with the unit of measurement in degrees (°). The default value for these errors is set at 5°. This parameter is essential for precise antenna orientation and antenna phase center alignment relative to the vehicle's coordinate system.

(13) INS to GNSS positioning antenna pol arm

Within the scope of the vehicle coordinate system, utilizing the inertial navigation system's center as the origin, the vector direction is oriented towards the position coordinates of the GNSS positioning antenna. The values are expressed in decimal format, sequentially from left to right as X, Y, and Z, with the unit of measurement in meters (m).

Configuration Errors:

The lever arm configuration error is delineated. Positive decimal values are specified, corresponding to the X, Y, and Z axes from left to right, with the unit of measurement in meters (m). Should the configuration error be set to ≤0.01m, the algorithm will cease to make adjustments for the lever arm configuration error from the inertial navigation system to the GNSS positioning antenna. The default value is established at 0.5 meters. This stipulation is pivotal for the precise calibration of the spatial relationship between the inertial navigation system and the GNSS antenna, thereby influencing the accuracy of the navigation system's performance.

(14) Accuracy of Odometer Wheel Speed (If the device is not connected to wheel speed sensors, this parameter may be left blank)

Fill in the values based on the odometer wheel speed accuracy and the steering wheel angle accuracy. If the vehicle's precision indicators are unknown, fill in according to the signal resolution or the proportionality factor (≤1). The values are positive decimals, listed from left to right as wheel speed accuracy and steering angle accuracy, with the unit of wheel speed accuracy in meters per second (m/s) and the unit of steering angle accuracy in degrees (deg).

(15)Delay of Odometer (If the device is not connected to wheel speed sensors, this parameter may be left blank)

Wheel speed signal communication delay, if the delay metric is unknown, use the default value. Positive number, unit (milliseconds), default is 20ms.

(16)Track

The distance between the vehicle's wheels. Positive decimal, from left to right are the distances for the left-right wheelbase and the front-rear wheelbase, with the unit (meters), default is 1.6m/2.7m.

2.8.3 Compass Display

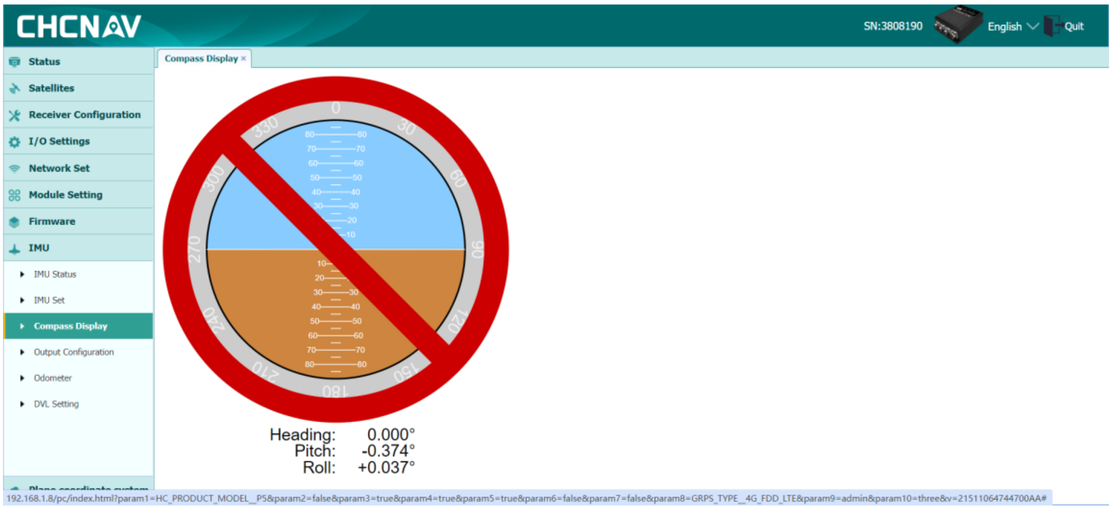
Click "Compass Display," you can view the attitude compass of the receiver. It simulates the first-person perspective of the airborne device, with blue representing the sky and brown representing land:

When the carrier (device) leans to the right, the compass horizon (the boundary line between blue and brown) tilts to the left, and the Roll output is positive; when the carrier (device) leans to the left, the compass horizon tilts to the right, and the Roll output is negative.

When the carrier (device) pitches up, the compass horizon moves downward, and the Pitch output is positive; when the carrier (device) pitches down, the compass horizon moves upward, and the Pitch output is negative.

When the carrier (device) rotates clockwise on the horizontal plane, the compass heading scale rotates counterclockwise, with the Heading increasing from 0 to 360 (resetting to zero at 360).

Once the GNSS orientation status is "Oriented," the compass heading display is available and updates in real-time; when the GNSS orientation status is "Not Oriented," the compass heading display is disabled.



2.8.4 Output Configuration

“Output Configuration” can be configured as Serial Port C, Serial Port 422, internal file, and CAN, and the required data protocols and output frequencies can be selected according to the actual application scenario.

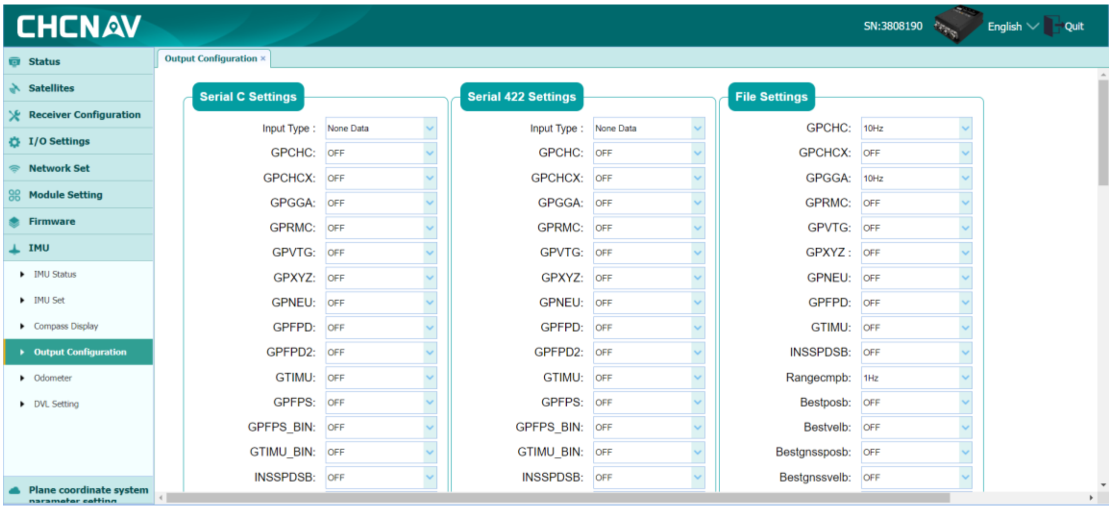
① Serial Settings

Serial port settings are used to configure the input and output of data through the serial port. Currently, two types of input data are supported: differential data and command data. If the input type is set to differential data, differential data can be input through Port C, and the device can achieve RTK calculation effects by receiving the differential data. In this input mode, there is no need to obtain differential data through the network.

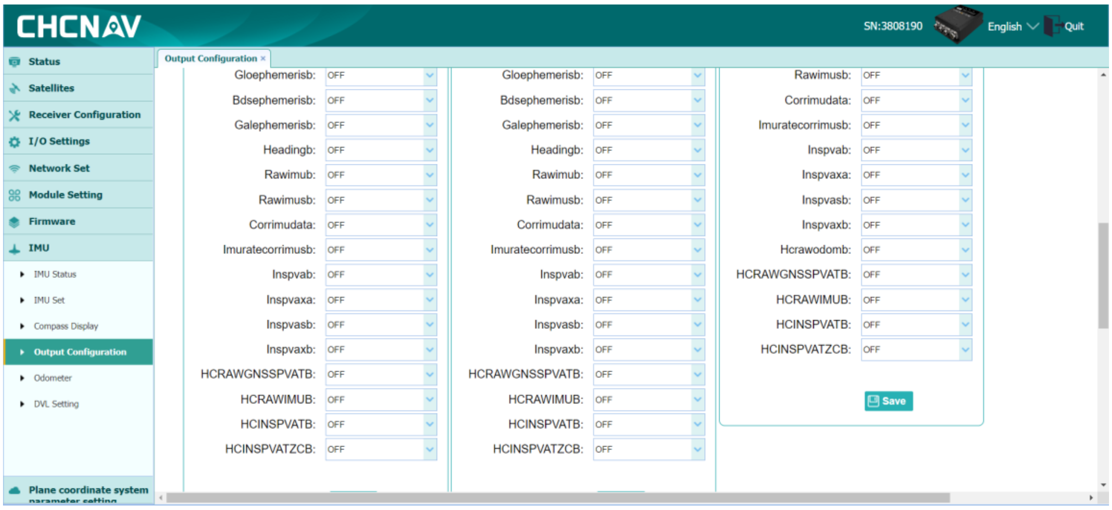
When configuring serial port output data, the specific data types that can be selected include integrated navigation data, GNSS module data, and raw IMU data, among others.

② File Settings

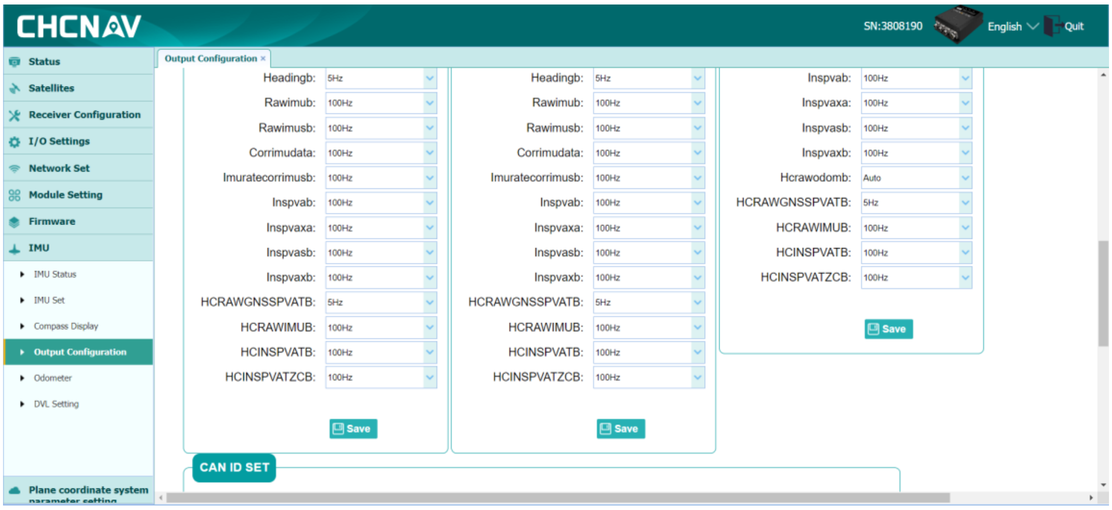
File settings, like serial port output mode, can output integrated data, GNSS module data, and raw IMU data, among others. The saved path can be used to copy data via FTP; this method does not allow for real-time viewing of the current device data. If there is a high volume of output data with a high frequency, file settings can be used for output.



The picture indicates that all data outputs are turned off.

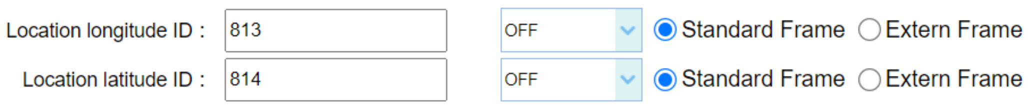


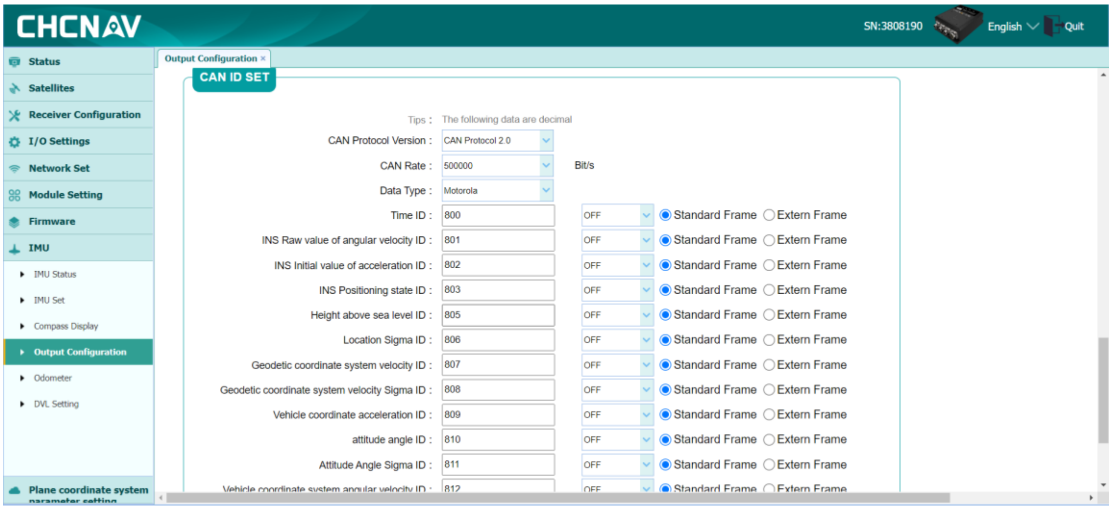
The picture indicates that all data outputs are turned on at the highest frequency.



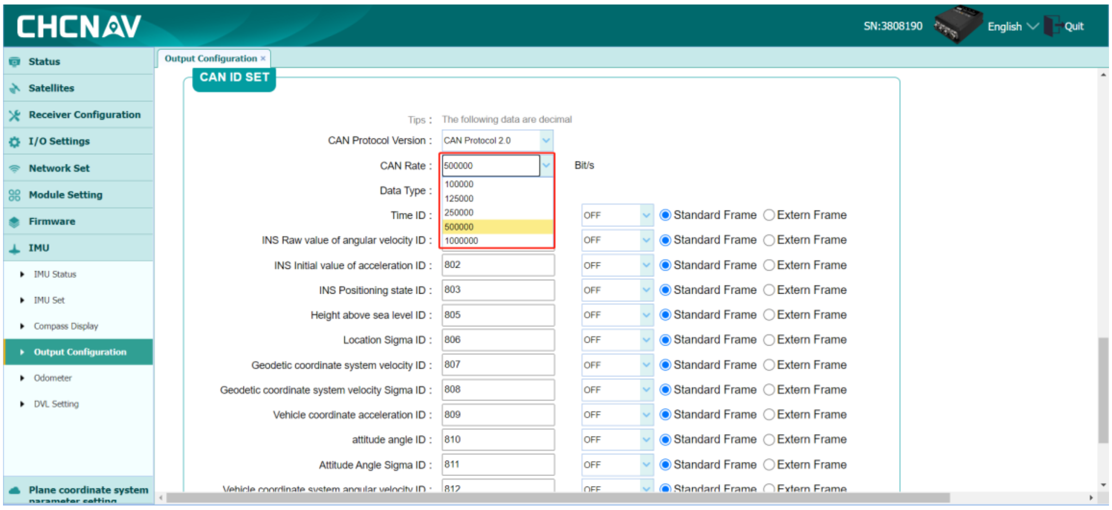
③ CAN ID SET

The CAN ID settings allow you to modify the default CAN ID to prevent CAN ID conflicts. The CAN ID displayed in this interface is in decimal format, while the actual data output from the CAN port is in hexadecimal. For example, if the CAN ID for time is 800, then the actual output time CAN ID is 320 in hexadecimal. To obtain the desired hexadecimal CAN ID, modify the corresponding data's CAN ID to the corresponding decimal number in this interface and click save.

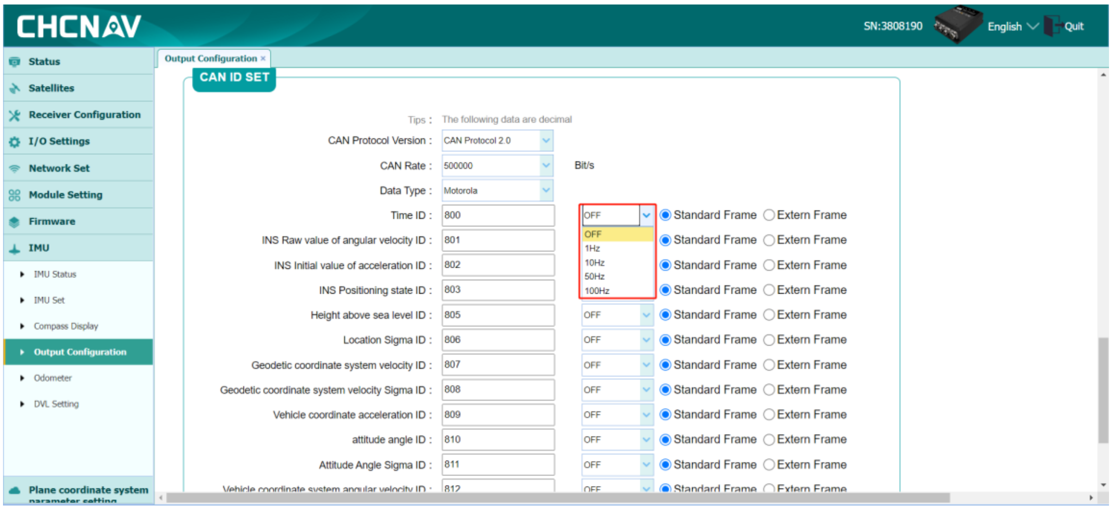




The output rate of the CAN port is adjustable from 100,000 to 1,000,000 (100K-1000K) bits per second. The control of the CAN port output allows you to change the data frequency of the CAN port output (1-100 Hz).



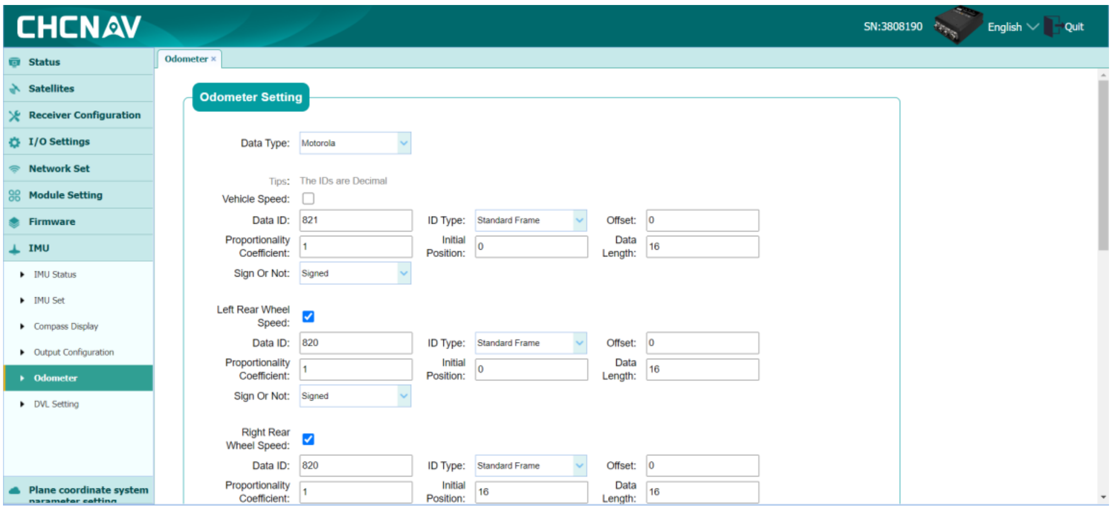
The CAN port output can adjust the data output frequency of the CAN port to (1, 10, 50, 100 Hz).

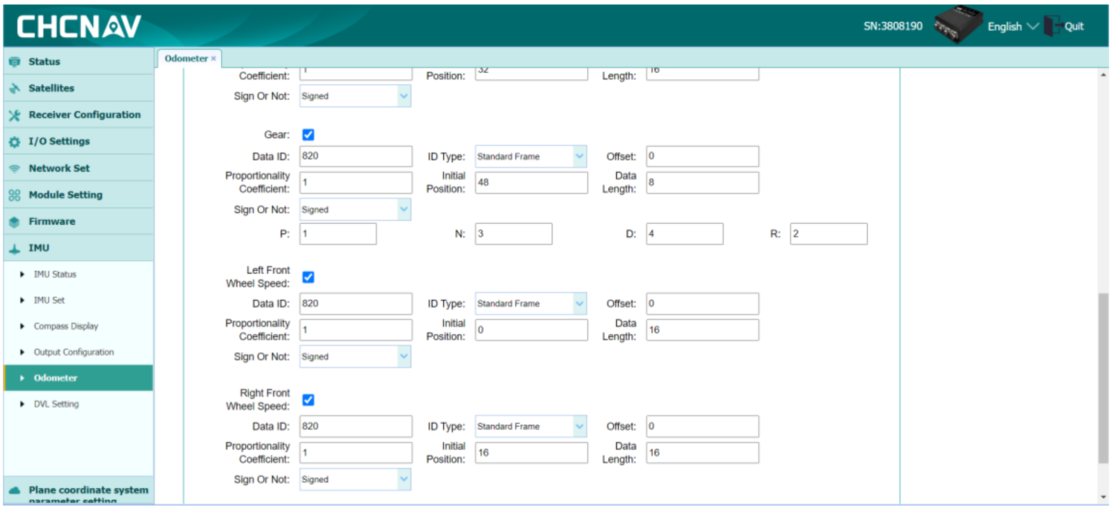


It also supports modifying the type of ID, which is divided into standard frame and extended frame. The range of the standard frame is 000-7FF, and the range of the extended frame is 0000 0000-1FFF FFFF. Taking the time ID as an example, if the decimal ID is 800, if you choose the standard frame, the CAN ID in the output information will be 0x320; if you choose the extended frame, the CAN ID will be 0x0000 0320, and other IDs will follow suit.

2.8.5 Odometer Settings

This product supports the connection of an external odometer to improve positioning accuracy. After connecting the wheel speed signal from the CAN port, relevant configuration is required. For specific configuration methods, see *Section 3.5*. The configuration interface for the odometer is shown in the figure below:

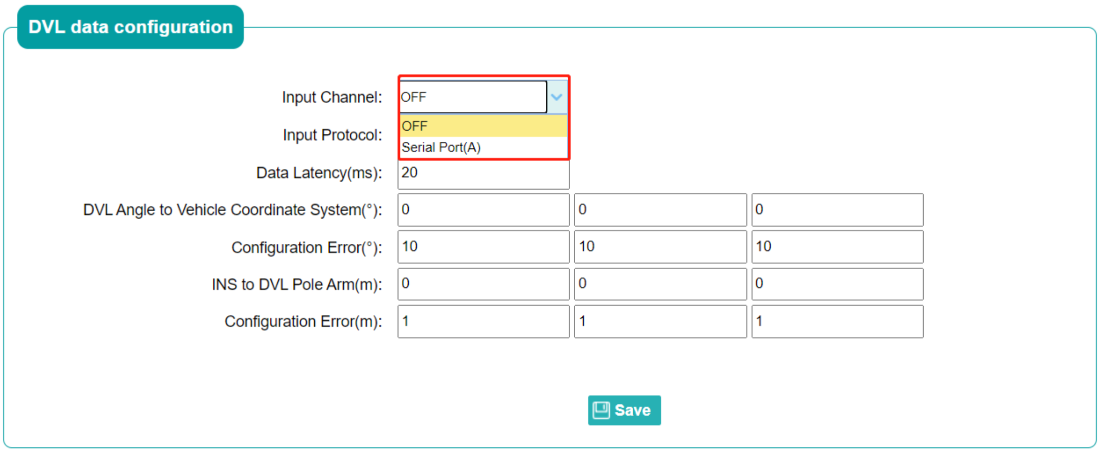




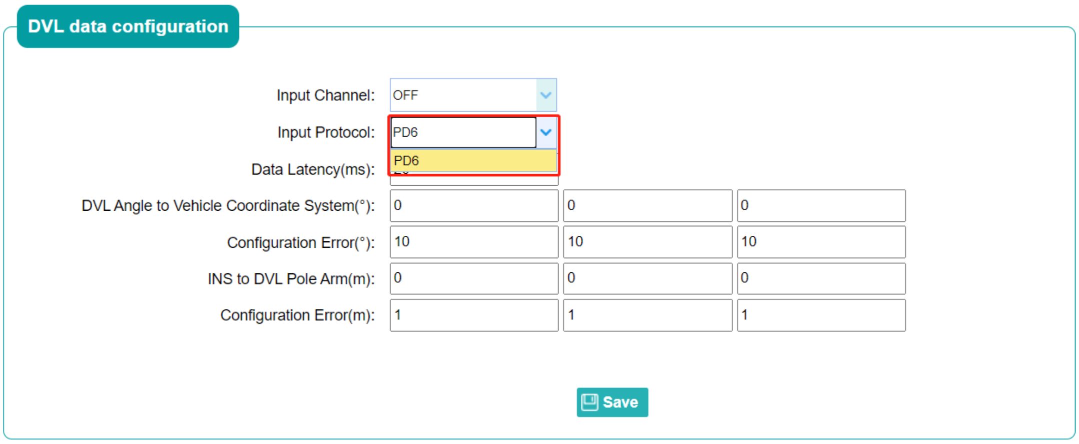
2.8.6 DVL data configuration

The settings for DVL are consistent with the vehicle parameter configuration rules within the inertial navigation setup, both of which are based on the vehicle coordinate system, with positive values assigned for the right, front, and upward directions when measuring the lever arm.

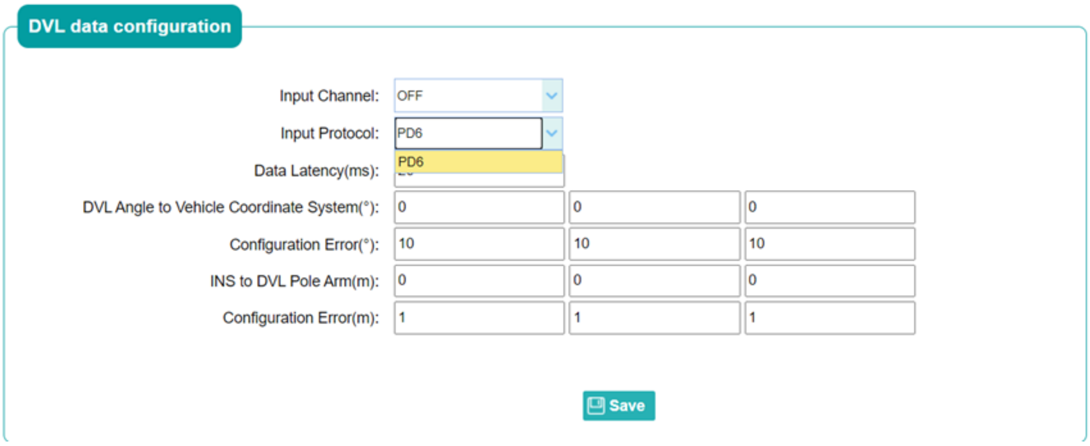
The Input Channel configuration is turned off by default. Once activated, it can be selected to connect with Serial Port A.



The default selection for Input Protocol settings is PD6.

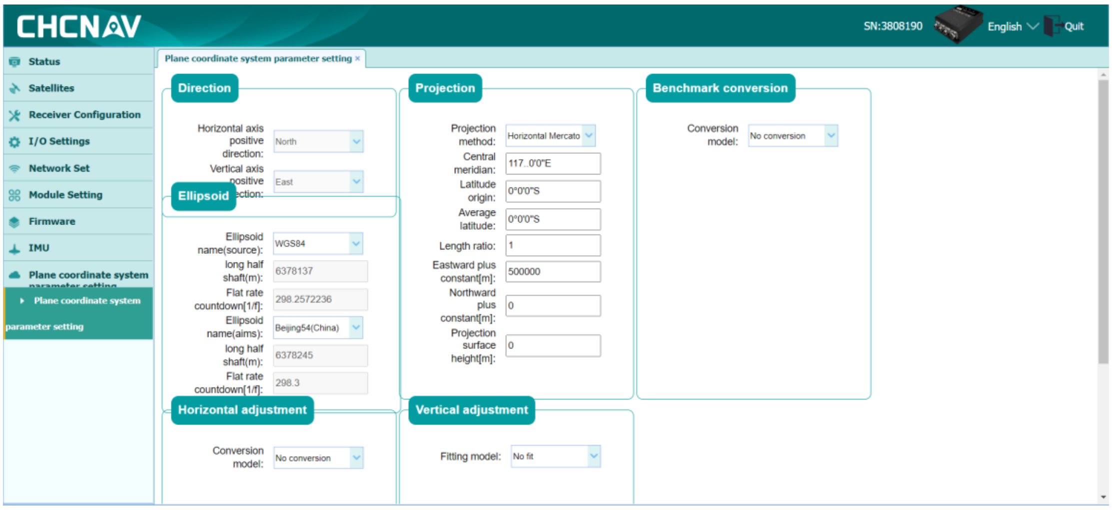


The default data delay is set at 20 milliseconds. DVL stands for Doppler Velocity Log. The coordinate system of the DVL, when installed relative to the vehicle coordinate system, can be understood as the angle between the GNSS heading baseline and the carrier coordinate system. The configuration of the lever arm from the inertial navigation system to the DVL can be understood as the lever arm from the inertial navigation system to the positioning antenna.



2.9 Planar Coordinate System Parameter Setting

This product supports the output of planar coordinates. After configuring the planar parameters on the web page, the planar coordinates can be output in the GPNEU data protocol.


CHCNAV
SN:3808190
English
Quit
Status
Satellites
Receiver Configuration
I/O Settings
Network Set
Module Setting
Firmware
IMU
Plane coordinate system parameter setting
Plane coordinate system parameter setting
Direction
Horizontal axis positive direction:
North
Vertical axis positive direction:
East
Ellipsoid
Ellipsoid name(source):
WGS84
long half shaft(m):
6378137
Flat rate countdown[1/f]:
298.2572236
Ellipsoid name(aims):
Beijing54(China)
long half shaft(m):
6378245
Flat rate countdown[1/f]:
298.3
Projection
Projection method:
Horizontal Mercato
Central meridian:
117..0'0"E
Latitude origin:
0°0'0"S
Average latitude:
0°0'0"S
Length ratio:
1
Eastward plus constant[m]:
500000
Northward plus constant[m]:
0
Projection surface height[m]:
0
Benchmark conversion
Conversion model:
No conversion
Horizontal adjustment
Conversion model:
No conversion
Vertical adjustment
Fitting model:
No fit

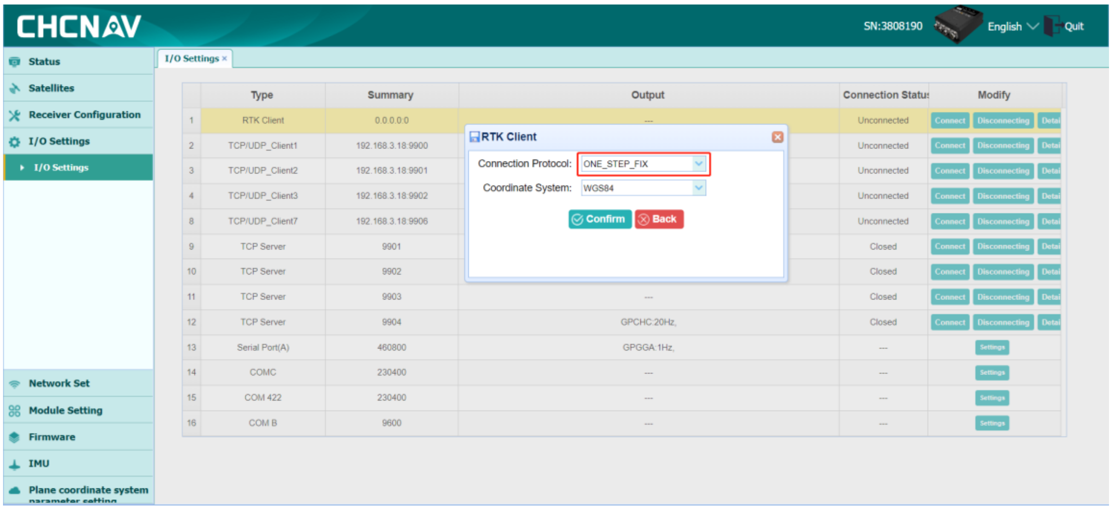
3 Basic Operation Instructions

3.1 Differential Data Setting

3.1.1 One-step-fix

Refer to Section 1.8.3 for SIM card installation, and check whether the network status in the network settings shows 'SIM Normal' and the dialing status is “Connected”.

Click on “I/O Settings” -> “RTK Client”, click “Connect”, select the connection protocol as ONE_STEP_FIX, and choose the coordinate system as WGS84/CGCS2000/ITRF2014, then click “OK”. If the connection status shows “Logged In”, it indicates that the differential data access has been successful.



3.1.2 NTRIP Account for Delivering Differential Data

Refer to *Section 1.8.3* for SIM card installation and check in the network settings to see if the network status shows “SIM Normal” and the dialing status is “Connected”.

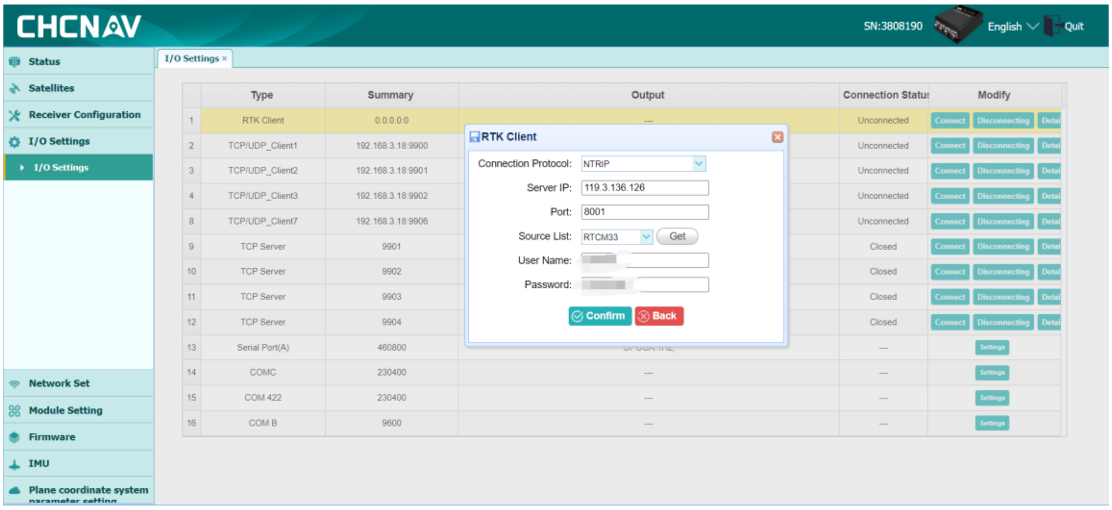
Enter the I/O Configuration interface, select “RTK Client”, and click “Connect”. The connection protocol can be chosen as the NTRIP/TCP protocol. After entering the IP and port number, click “Retrieve” to select the corresponding source list. Then, enter the account password and other related information, and finally click “OK”. If the connection status shows “Logged In”, it indicates that the differential data access has been successful.

SWAS Account Information:

IP: 119.3.136.126

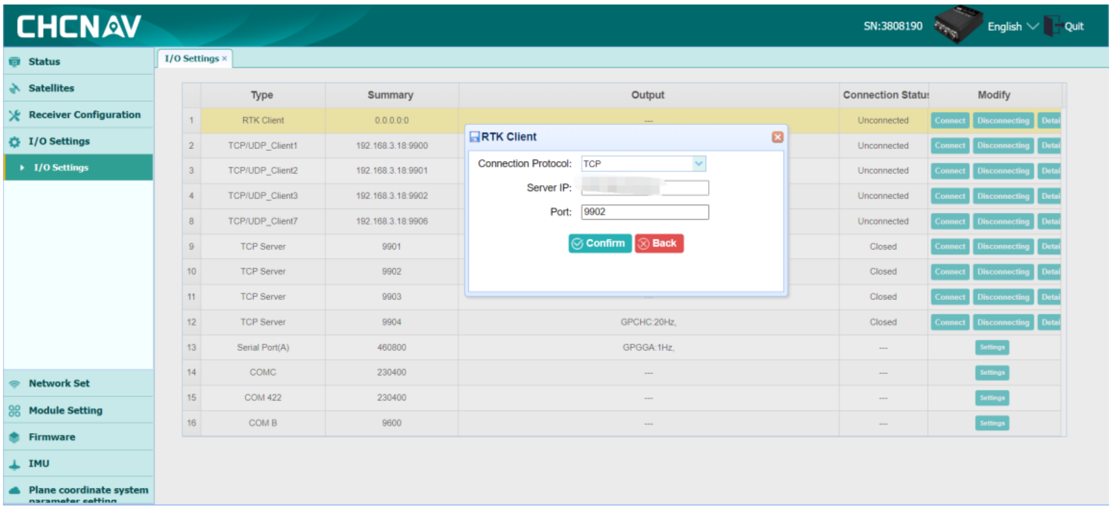
Ports: 8001/9001 are for the CGCS2000 coordinate system, and 8002/9002 are for the WGS84 coordinate system.

Source Nodes: RTCM411 (Four-star eleven frequency), RTCM33 (Five-star sixteen frequency, used for ports 8001/8002), AUTO (Five-star sixteen frequency, used for ports 9001/9002).



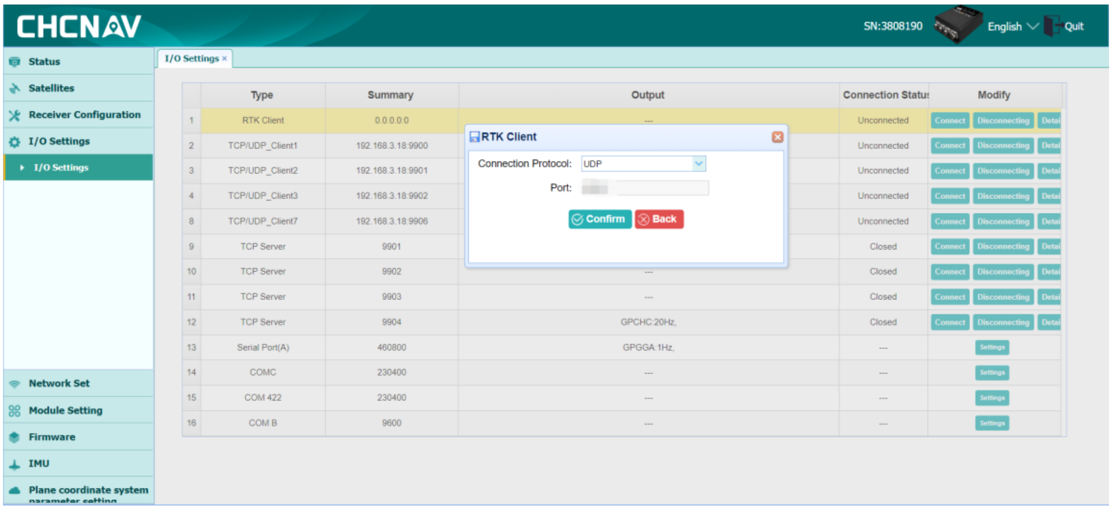
3.1.3 TCP for Delivering Differential Data

By connecting via Ethernet, ensure that the IP addresses of the client and server are in the same subnet. Enter the remote IP and corresponding port number in the I/O settings to receive the differential data transmitted over Ethernet.



3.1.4 UDP for delivering Differential Data

By connecting via Ethernet, ensure that the IP addresses of the client and the server are within the same subnet. Enter the port number in the I/O settings to receive the differential data broadcasted over Ethernet.



3.2 IMU Set

By clicking on IMU on the left and then IMU Set, you can perform IMU Data Configuration, INS Data Settings, Alignment Configuration, and Vehicle Parameter Settings for the receiver. Please refer to Section 2.8.2 for detailed instructions related to inertial navigation configuration.

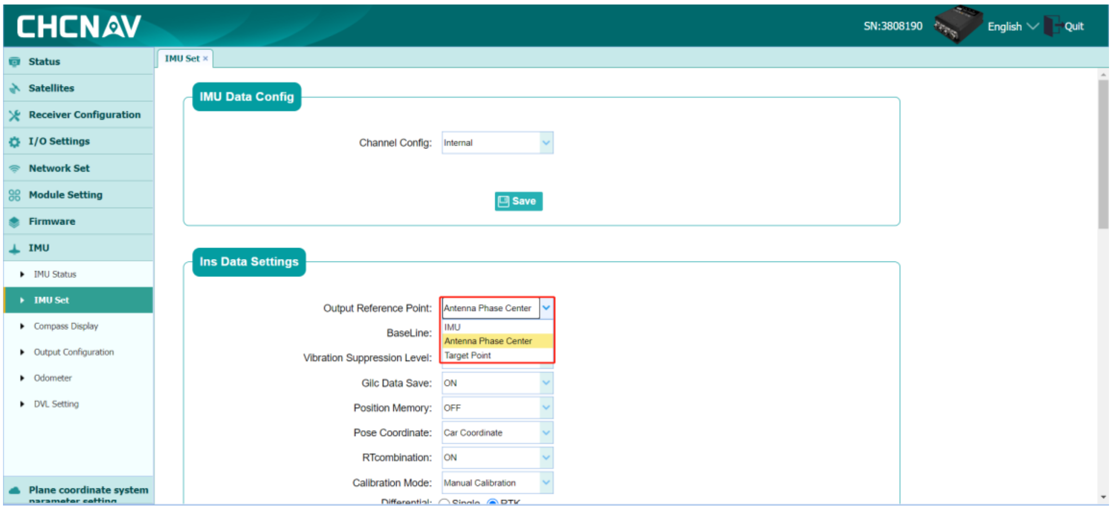
(1) IMU Data configuration

The channel configuration allows you to choose whether the IMU is internal or external. When selecting an external IMU, you need to connect to another IMU device using the IMU cable set through the aviation connector.

(2) Ins Data Settings

① Output Reference Point

You can choose from IMU, antenna phase center, or target point. When selecting the target point as the output reference point, you need to enter the vector coordinates from the positioning antenna phase center to the target point in the vehicle coordinate system; the default is the positioning antenna phase center.



② BaseLine

When the dual antennas are installed side by side, and the difference between the vehicle's heading angle and the dual antennas' heading angle is not 90°, it indicates a possible heading anomaly. Therefore, it is necessary to configure this item for optimization.

③ Vibration Suppression Level

For different installation carriers, different vibration suppression levels (0-5) are provided. When the carrier experiences severe vibration, a higher level of vibration suppression (3-5) can be selected to smooth the IMU's data output. The default level is suitable for ordinary vehicles (2).

Notice: The filtering and noise reduction is a low pass filtering process, which introduces a delay of up to 10 milliseconds. The default level 2 corresponds to a 40Hz bandwidth, and with each increase in level, the bandwidth is halved.

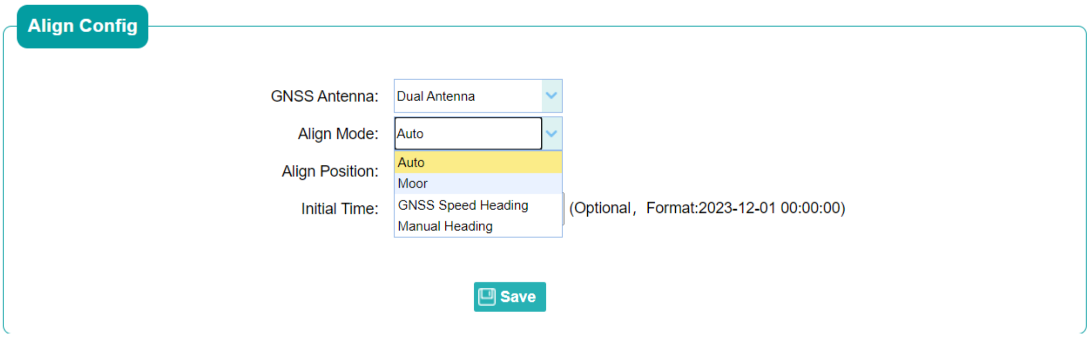
④ Glic Data Save

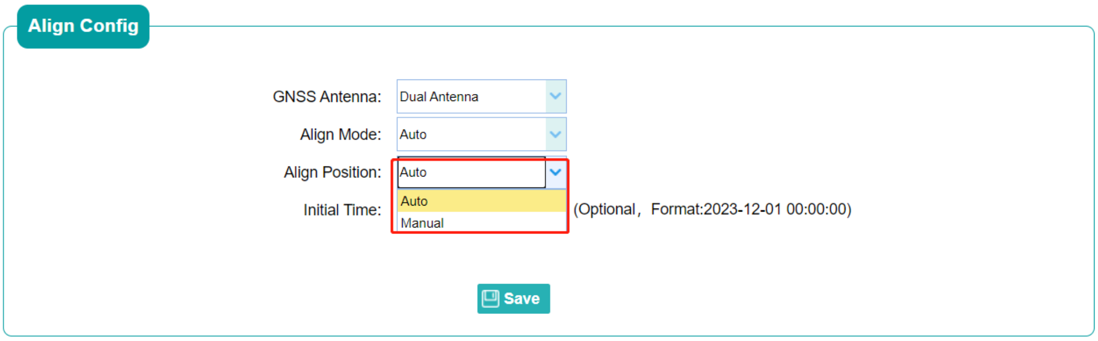
Set the internal IMU logs, raw data, and other recording files of the device. Turning off the algorithm logs can reduce system load and the probability of data packet loss, but once turned off, it will not be possible to record the device status or analyze device issues. It is recommended to keep it turned on.

(3) Alingn Config

In the selection between single and dual antennas, choose the single antenna or dual antenna option based on the actual usage situation. The alignment mode supports automatic, moored (1, 5, 10, 15 minutes), GNSS speed and heading, and manual heading, with the default alignment mode set to automatic. The alignment position should be set to automatic when the antenna is connected; manual settings are only supported in the no-antenna mode.

Notice: When the no-antenna mode is selected, the alignment mode only supports mooring and manual heading, and it is necessary to enter the initial time. The time format should be:2024-02-29 00:00:00.





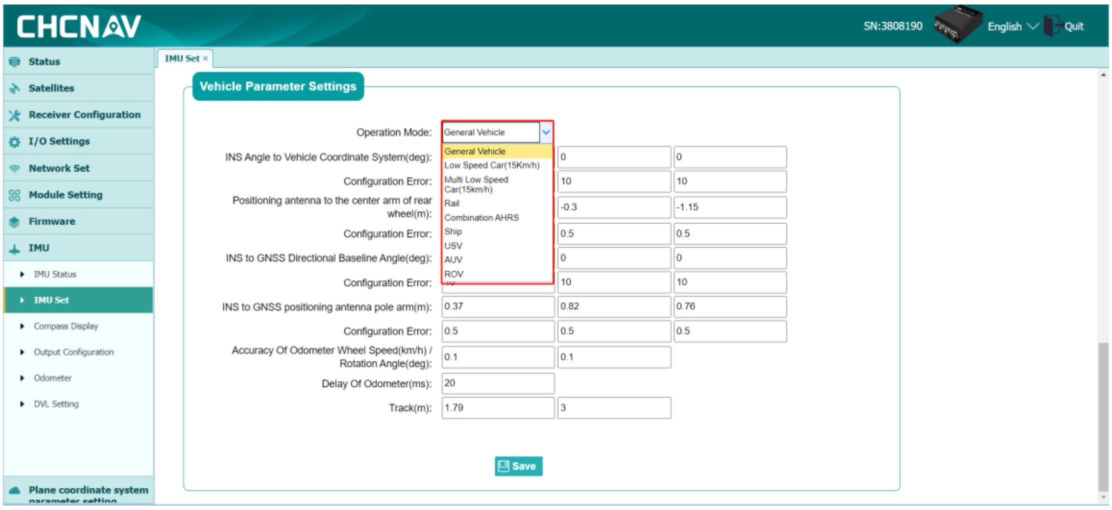
(4) Vehicle Parameter Settings

① Operation Mode

The device supports various working modes for different application scenarios, which are as follows: General Vehicle Mode (suitable for general automobiles with a maximum speed greater than 15 km/h), Low Speed Car Mode (typically used for inspection robots with a maximum speed less than 15 km/h), Multi-Wheel Steering Low-Speed Vehicle Mode (suitable for carriers with omnidirectional wheels or capable of lateral/diagonal movement), Rail Transit (suitable for high-speed trains, trains, etc.), Integrated AHRS, Marine Vessel, USV (Unmanned Surface Vehicle), AUV (Autonomous Underwater Vehicle), ROV (Remotely Operated Vehicle), etc., for details, see the table below.

Mode	Carrier model specification	Usage scenario

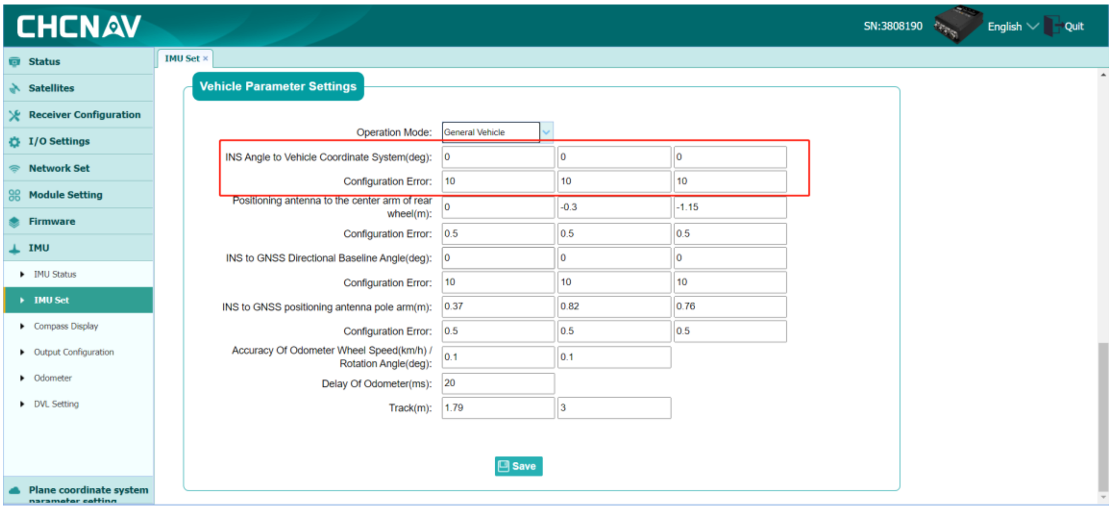
General Vehicle	Suitable for general passenger cars and commercial vehicles, where the driven wheels do not experience lateral displacement	Four-wheeled sedans, vans, tour buses, and four-wheeled unmanned vehicles
Low Speed Car	Suitable for four-wheeled or multi-wheeled carriers and tracked vehicles with a speed less than 15 km/h	Tracked vehicles, low-speed logistics vehicles, inspection vehicles, street sweepers, and other engineering machinery.
Mult Low Speed Car	Suitable for carriers with omnidirectional wheels or capable of lateral/diagonal movement	Harbor straddle carriers, port cargo trucks, and carriers with omnidirectional wheels.
Rail	Suitable for trains and high-speed rail that perform reverse starting maneuvers, as well as rail-bound or BRT (Bus Rapid Transit) smart track virtual track vehicle carriers	Trains, high-speed rail, and other rail-bound or BRT (Bus Rapid Transit) smart track virtual track vehicle carriers.
Combination AHRS	Suitable for non-vehicle carriers that require attitude and position	Mechanical arms, excavators, etc.
Ship	Suitable for ships that are not affected by ocean currents or are minimally affected by them	Large cruise ships, cargo ships (in the tonnage class)
USV	Suitable for unmanned surface vessels, or in conditions with significant ocean currents	Small boats, unmanned surface vessels.
AUV	Suitable for underwater autonomous underwater vehicles without cables	Autonomous Underwater Vehicles (AUVs) that are wirelessly connected to the outside world
ROV	Suitable for underwater vehicles connected to a mothership with a cable	Remotely Operated Vehicles (ROVs) that are connected to the surface with a tether

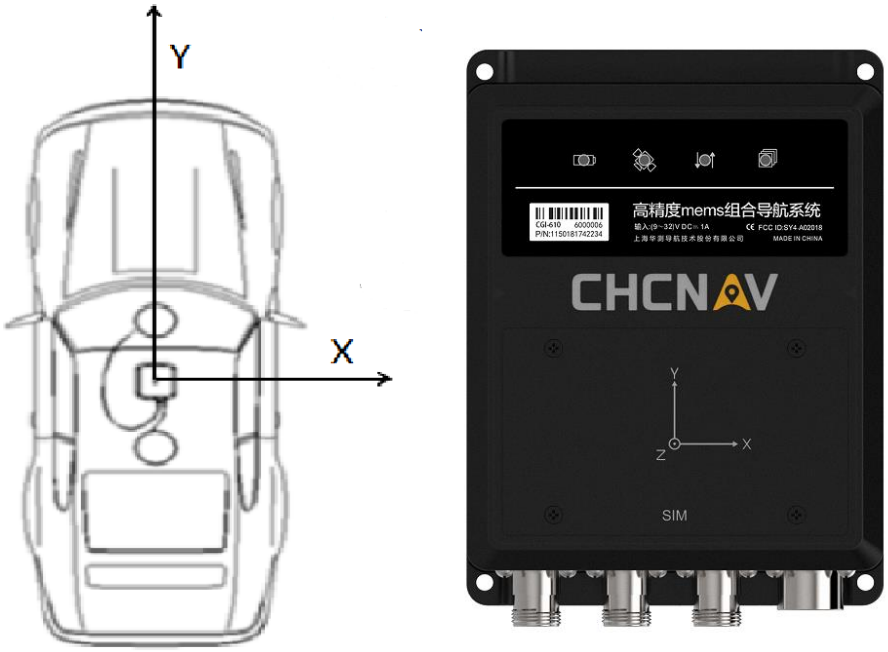


② INS Angle to Vehicle Coordinate System(deg)

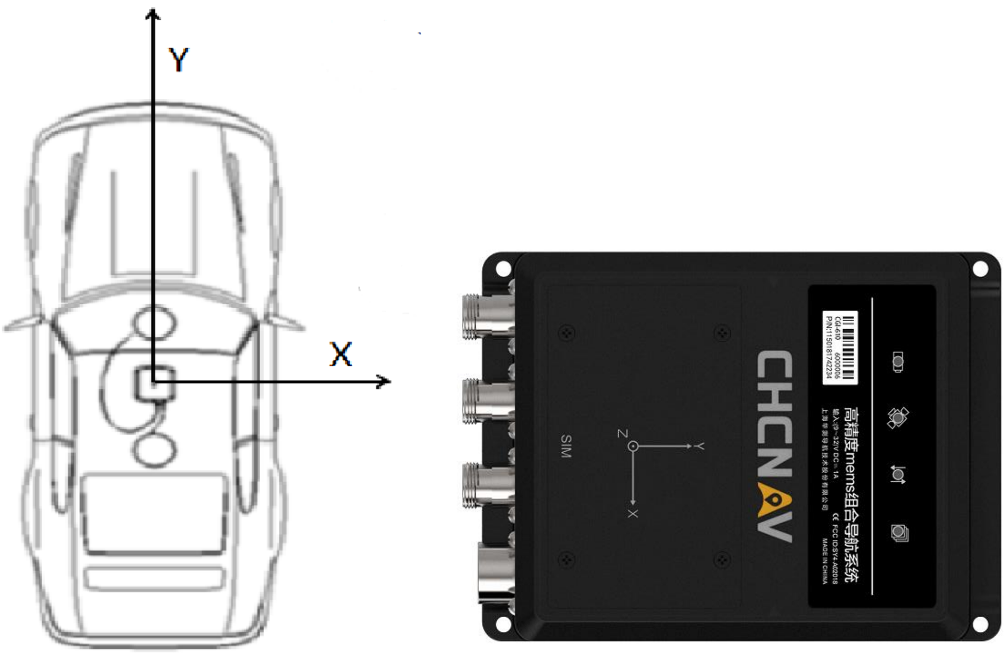
When setting the "angle from the inertial navigation system to the vehicle coordinate system," the angles represent the pitch, roll, and heading of the device relative to the vehicle. The rotation angles and their positive or negative values comply with the right-hand rule. For standard placement (with the device placed horizontally and the Y-axis arrow pointing forward), all inputs should be set to 0, as shown in Figure 3.2.1; if the device is installed on the left and right sides, with the cable side on the left, the device rotates 90 degrees around the Z-axis towards the X-axis. According to the right-hand rule, the third field should be input as -90.

As illustrated in the following figure:





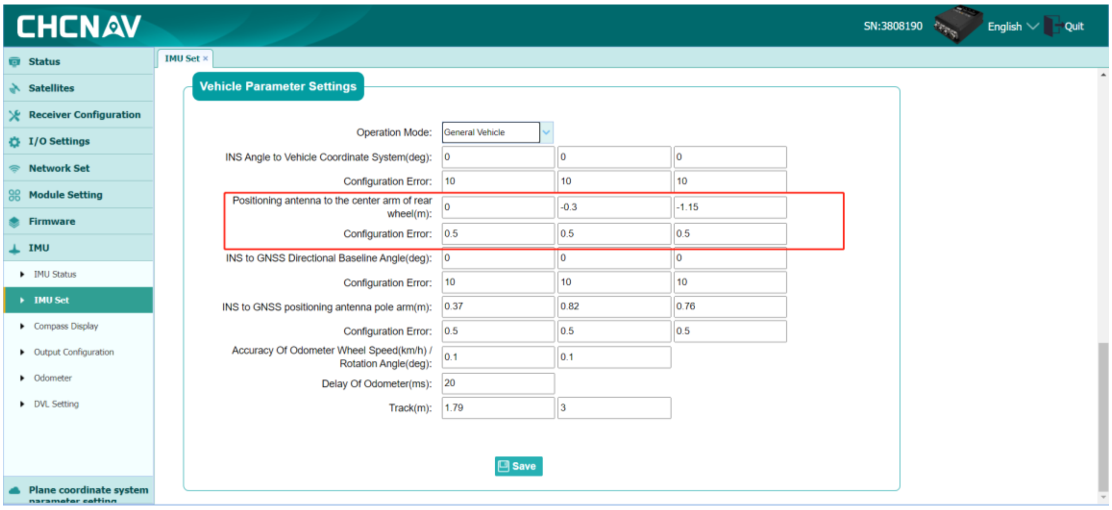
3.2.1 standard placement



3.2.2 the device rotates 90 degrees around the Z-axis towards the X-axis

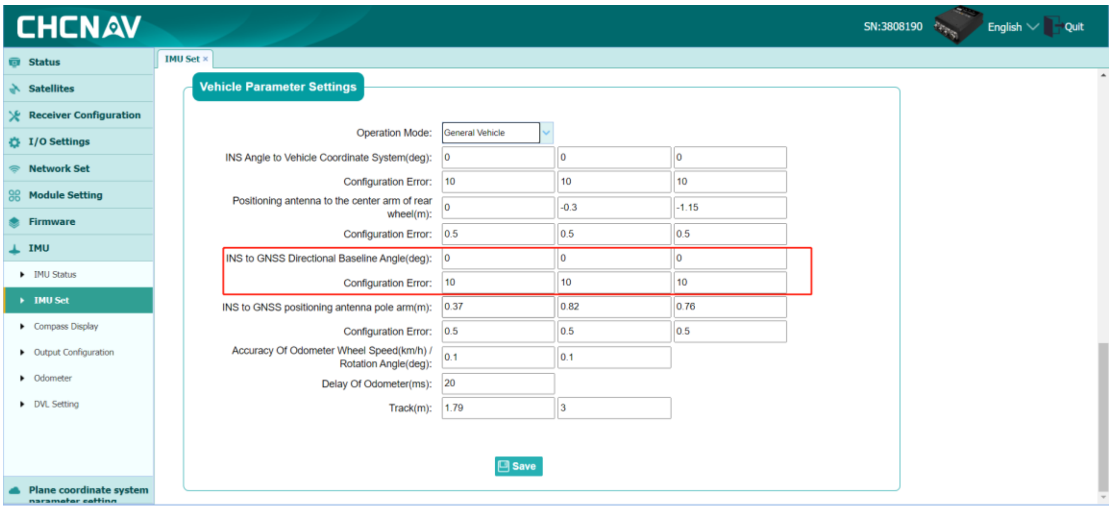
③ Positioning antenna to the center arm of rear wheel

When setting the "position of the positioning antenna to the center arm of rear wheel," the values for x, y, and z correspond to right, front, and up directions, respectively, with positive values indicating right, front, and up. The directions are as follows: The left-right direction is represented by the x-axis. The front-back direction is represented by the y-axis. The up-down direction is represented by the z-axis. The units are in meters. For example, if the antenna is positioned 0.3 meters to the left of the rear wheel center (which would be 0 if placed on the vehicle's central axis), 0.5 meters in front, and 1 meter above, the input values would be as follows: X value: 0.3 (for the left side),Y value: -0.5 (for the front side, which is negative because it's in the opposite direction of the y-axis),Z value: -1 (for the upper side, which is negative because it's in the opposite direction of the z-axis).So the input values would be represented as: 0.3, -0.5, -1.



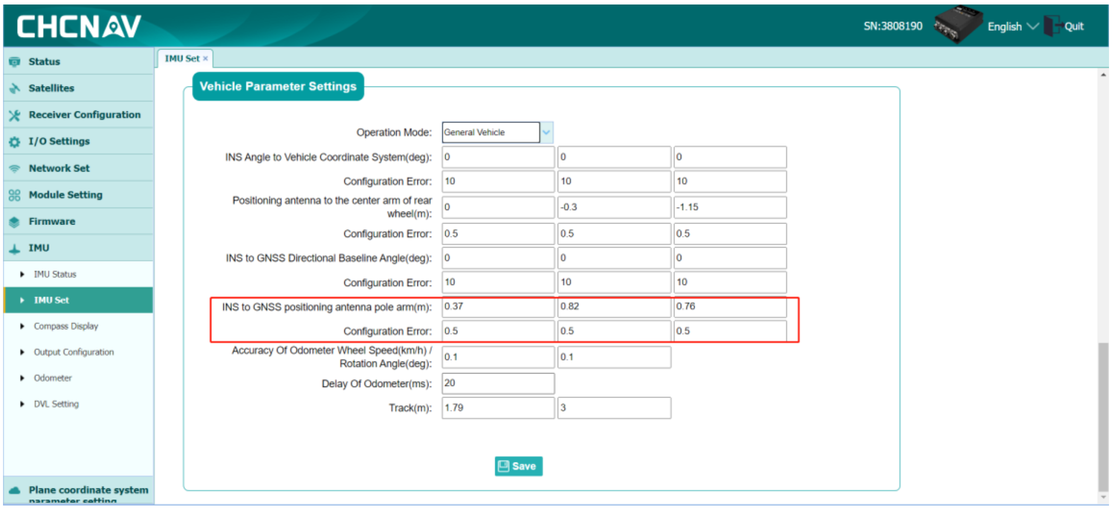
④ The angle from the GNSS heading baseline to the vehicle coordinate system

When setting the 'angle between the GNSS heading baseline and the vehicle coordinate system,' if the antennas are installed in a front-back configuration with similar heights, input zeros for all the fields. If the positioning antenna is located on the left side and the directional antenna is on the right side, then for the third field, input -90.



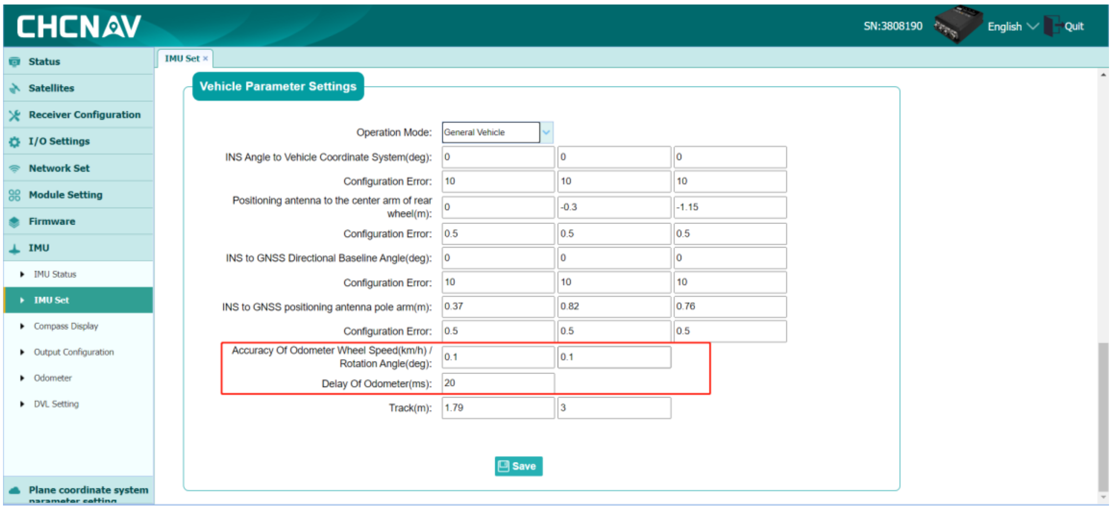
⑤ INS to GNSS positioning antenna pol arm

When configuring the 'INS to the GNSS positioning antenna pol arm' use the coordinates x, y, and z, with positive values indicating the right, front, and up directions, respectively. The x-axis corresponds to the left-right direction, the y-axis to the front-back direction, and the z-axis to the up-down direction. The unit of measurement is in meters. If the positioning antenna is situated to the right front and above the device, the corresponding coordinates are positive:



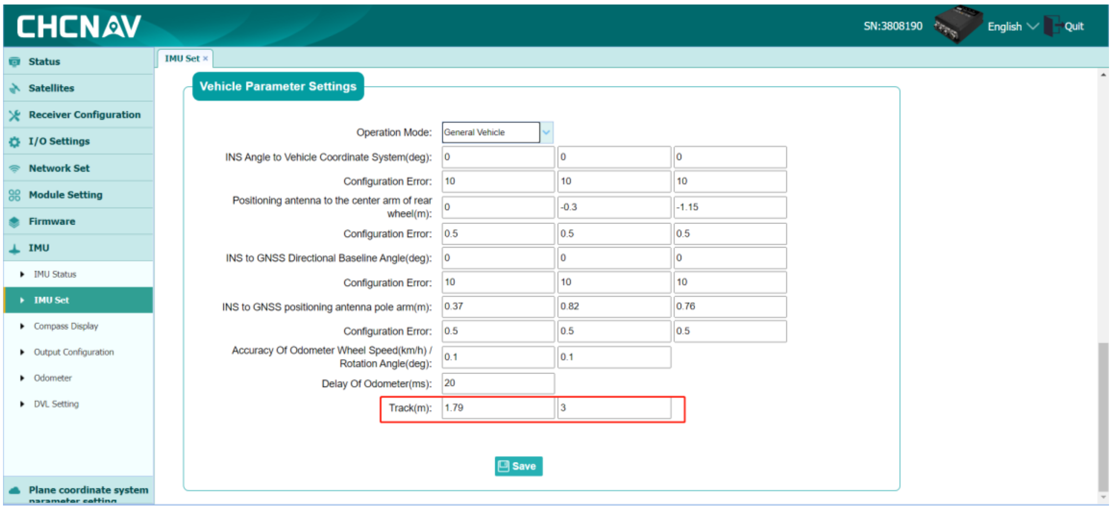
⑥ Accuracy of Odometer Wheel Speed and Delay of Odometer

When configuring the 'Odometer Wheel Speed Accuracy (km/h) / Heading Accuracy (deg)' and 'Odometer Delay', the customer should supply the initial values for these parameters. In cases where there is no input available for the vehicle's wheel speed, these settings can be omitted or left at their default values.



⑦ Track

Set the 'Track' which includes both the distance between the left and right wheels and the distance between the front and rear wheels. After all settings are completed, click 'Save' to retain the configurations.



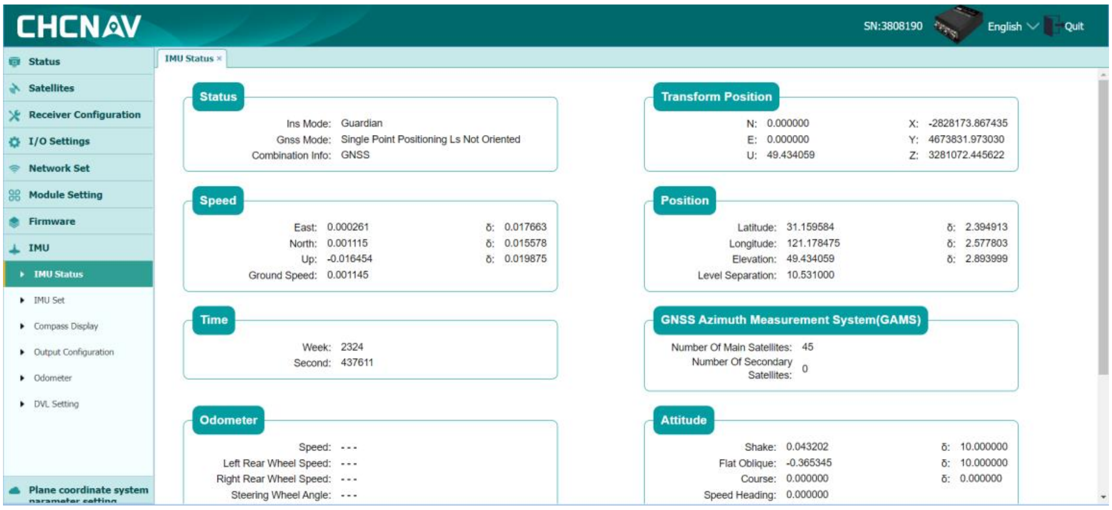
Note:

1) After setting up and saving, refresh the page and revisit the parameter settings interface to verify that the settings have been successfully saved to prevent inaccuracies from unsaved changes.

2) After clicking the 'Save' button in the above diagram, recalibration must be performed.

3.3 Device Initialization

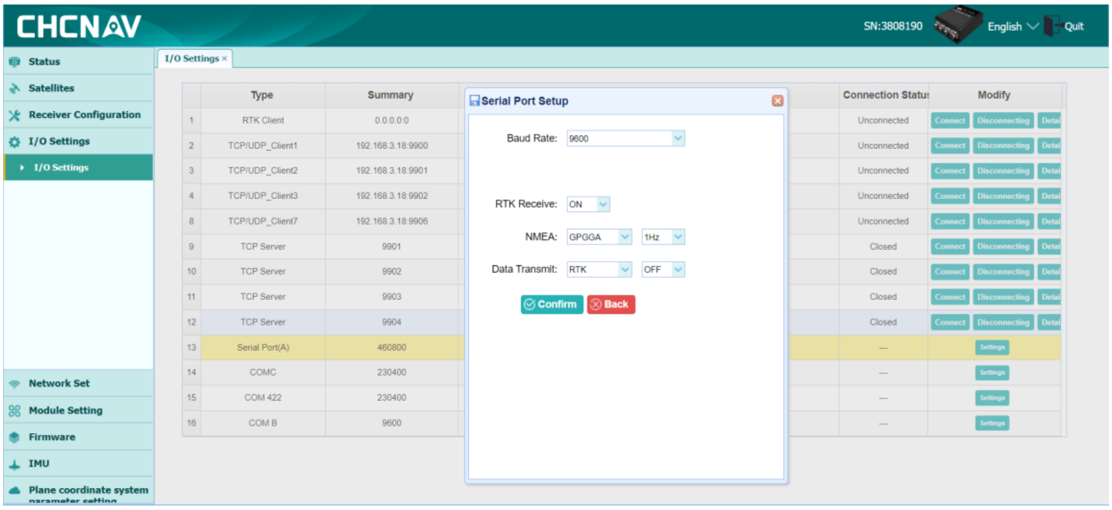
Once the parameter settings are complete, the device will begin the calibration process, known as 'running calibration.' Calibration only needs to be done once and takes approximately 5 minutes. After that, each time the device is started, the initialization time will be around 1 minute. The initialization status should be confirmed by the INS status on the webpage. When the INS mode displays 'Initializing,' it indicates that the initialization is in progress. 'Combination Info' indicates that the initialization is complete. You can also determine whether the initialization is complete by the status light on the front of the device; a solid green light signifies that initialization has been successfully completed.



3.4 Data Output

Click 'I/O Settings' to enter the configuration interface, select the serial port for data output you desire, and click the 'Settings' button to configure the baud rate.

Serial Port A corresponds to the cable's A_RS232 interface, where you can set the baud rate and NMEA-0183 data output. Serial Port A can also be configured to accept differential data.

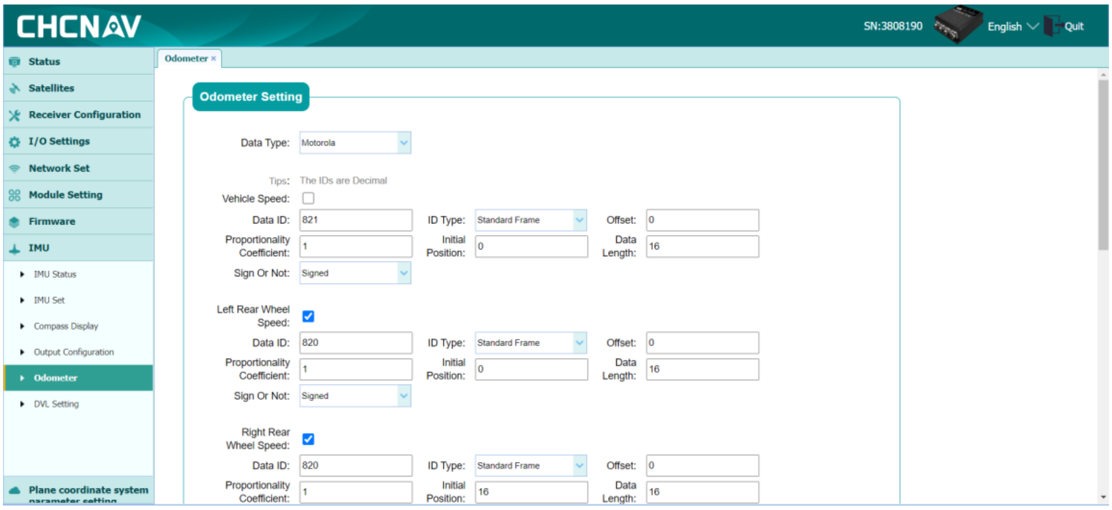


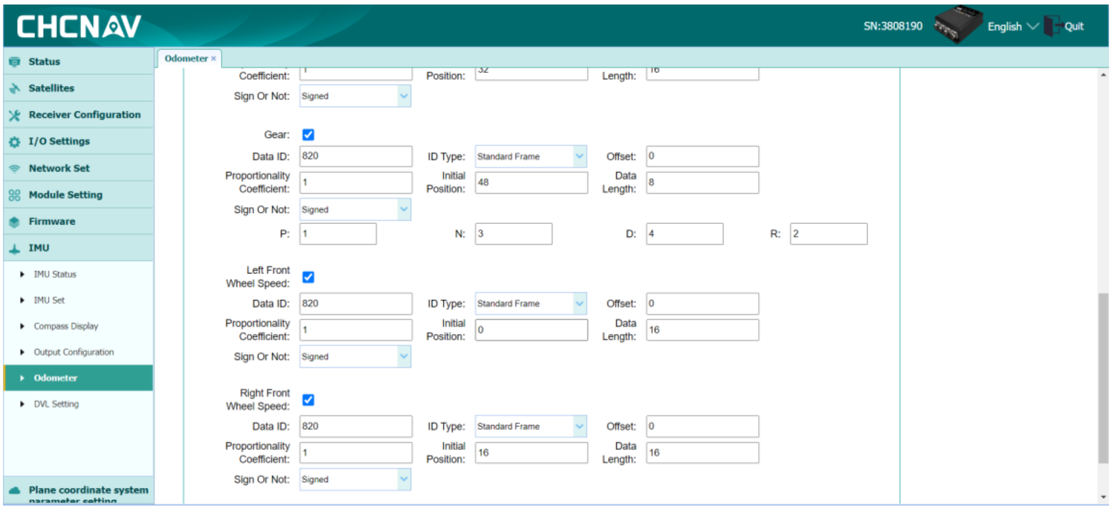
Serial Port C corresponds to the cable's C_RS232 interface, where in the I/O settings, you can only set the baud rate. The data output format is configured in 'IMU' - 'Output Configuration'. Specific data types include composite data, GNSS module data, and raw IMU data, among others.

In addition, it supports data input, typically for 'differential data' and 'commands'. If the input type is differential data, you can input differential data through Serial Port C and achieve RTK solution effects through the received differential data. In this input mode, there is no need to obtain differential data via the network.

3.5 Odometer Setting

This product supports the connection of an external odometer to enhance positioning accuracy. After connecting the wheel speed signal via the CAN port, relevant configuration is required. The configuration interface for the odometer is shown in the figure below.

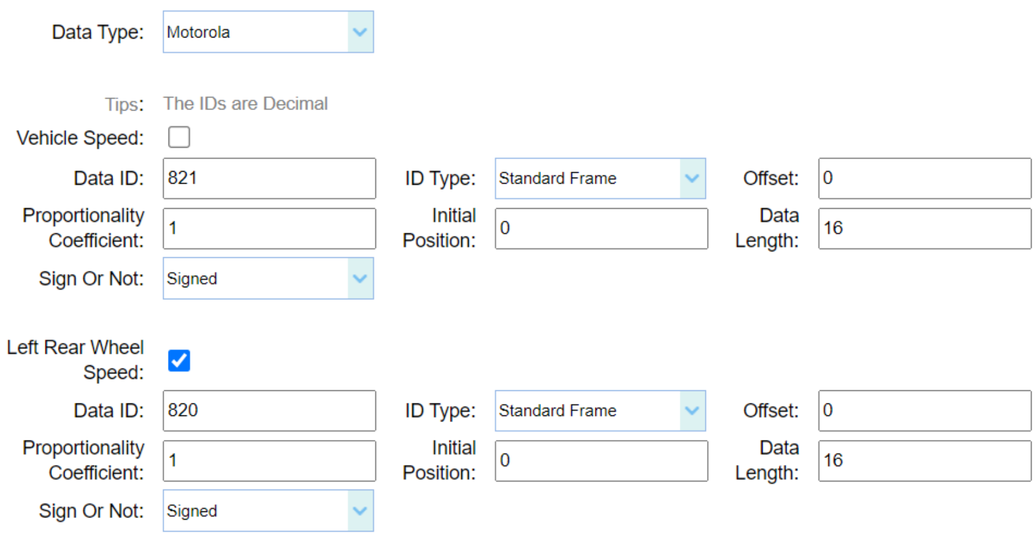


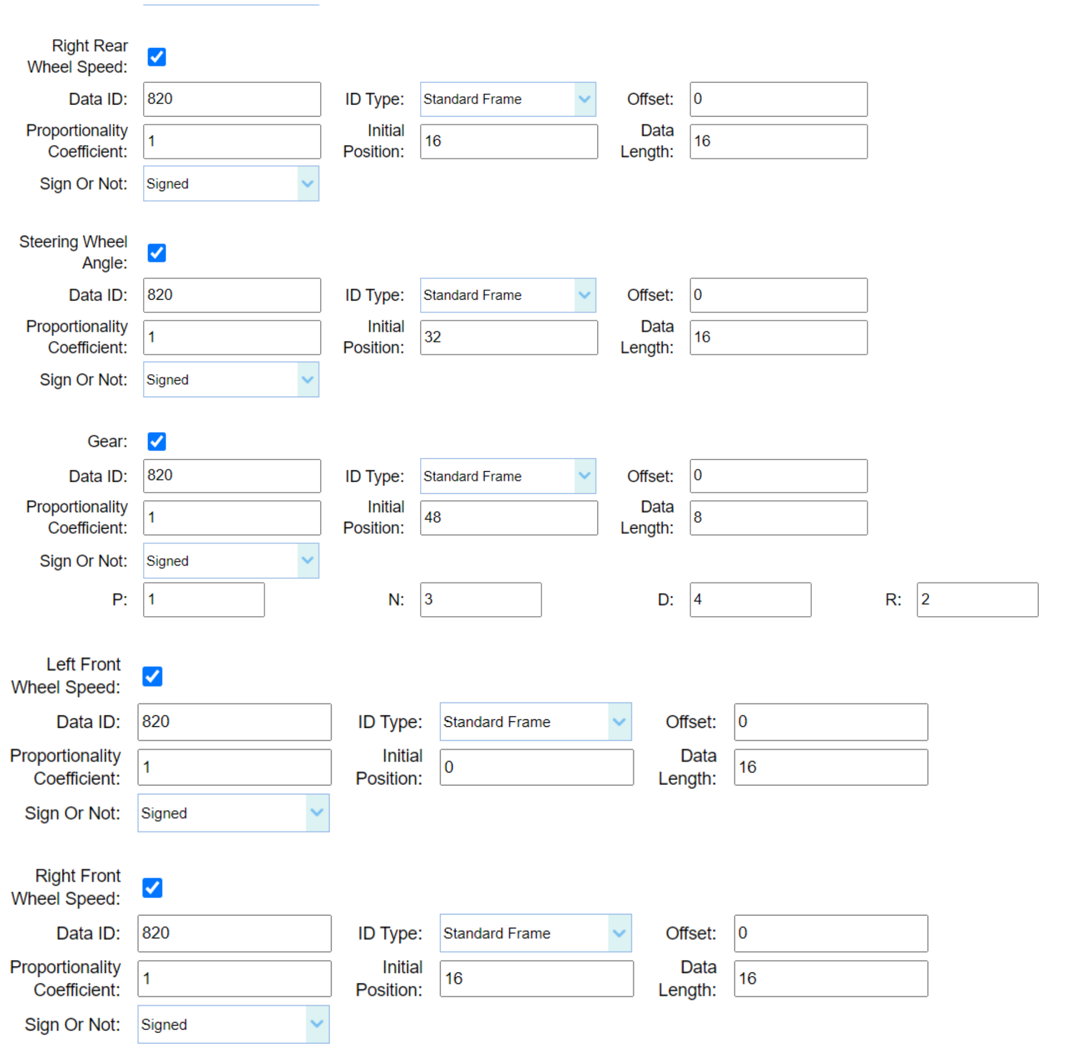


Track configuration requires the user to provide documentation that contains wheel speed information (DBC file), as illustrated in the table below. The necessary configuration information is all reflected within the table.

The following table is used as an example to configure odometer information, as shown in the figure:

Message name	**ID （HEX）**	**Initial position （Byte. Bit）**	**Order**	**Data length**	**Coefficient**	**Offset**	**ID type**	**Unit**	**Signal or not**
Vehicle speed	0x19FF402D	1.1	Intel	16	1/100	0	Extended frame	km/h	Not
Steering Wheel Angle	0x19FF402D	3.1	Intel	16	1/10	0	Extended frame	deg	Yes
Gear information	0x19FF402D	5.1	Intel	3	1	0	Extended frame	/	Not
Left rear wheel speed	0x19FF412D	5.1	Intel	16	1/100	0	Extended frame	km/h	Not
Right rear wheel speed	0x19FF412D	7.1	Intel	16	1/100	0	Extended frame	km/h	Not





Data formats are divided into Intel and Motorola formats; select the appropriate format based on the provided information. Vehicle speed left wheel speed, right wheel speed, steering wheel angle, and gear are the corresponding wheel speed data. If the input wheel speed information contains relevant data, then the corresponding checkbox should be ticked; otherwise, there is no need to tick it. Typically, the left and right wheel speeds refer to the speeds of the left and right rear wheels, respectively.

The Data ID is the identifier for the corresponding input information. For example, using the vehicle speed information provided in the table, the hexadecimal ID is 0x19FF402D. Convert this hexadecimal ID to a decimal number in a calculator:

Enter the corresponding decimal data of 436158509 into the Data ID field. Choose the Standard Frame or Extended Frame for the ID type based on the wheel speed information:

The Offset varies depending on the calculation method of the incoming wheel speed information. If the calculation method of the incoming information is in the form of Real Value = (Proportional Factor × Raw Value) + Offset, then the Offset value entered on the webpage should be the negative of the Offset. If the calculation method of the incoming information is in the form of Real Value = (Raw Value + Offset) × Proportional Factor, then the Offset value entered on the webpage should be the negative of the Proportional Factor times the Offset (Notice: The proportional factor in this calculation formula is the originally provided proportional factor, not the factor entered on the webpage after conversion). For example, if the Offset for the vehicle speed information is -20: if the customer's wheel speed information uses the first calculation method, then the Offset is 20; if the second calculation method is used, then the Offset is 0.2.

The Proportional Factor (or accuracy) is generally the reciprocal of the proportional factor, for example, the actual value entered for vehicle speed in the table is 100.

The Start Bit is the starting position of the data, usually starting from 0. For example, for vehicle speed, the table shows 1.1, enter the value as 0, for left wheel speed, which is 5.1, enter the value as 32 (5.1-1.1 equals 4 bytes = 32 bits). If the provided information includes the Start Bit, simply enter the original data as shown in the table:

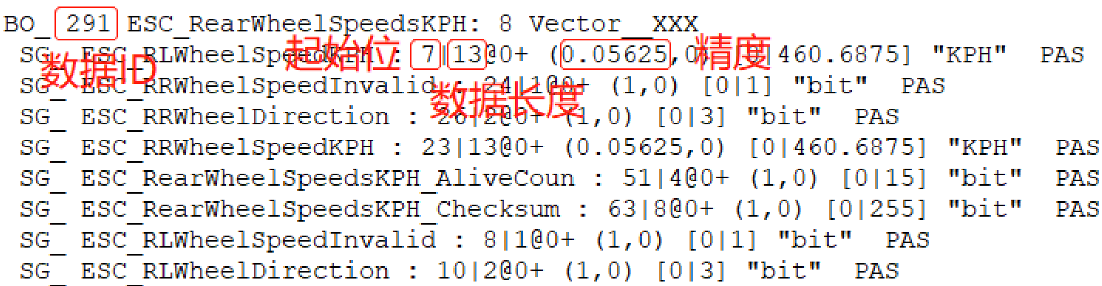
Signal Name	Signal Description	Byte Order (Intel/Motorola)	Start Byte	Start Bit

Wheel_Speed_RL_Data	Left rear wheel speed	Motorola LSB	2	20
Wheel_Speed_RR_Data	Right rear wheel speed	Motorola LSB	0	4
ESP_VehicleSpeed	Car speed	Motorola LSB	4	36
SAS_SteeringAngle	Steering wheel Angle	Motorola LSB	0	7
ACM_ActuatorPRNDStatus	Gear position PRND	Motorola LSB	0	7

The data length should be filled in according to the signal length defined in the wheel speed signal. For example, for vehicle speed, enter 16. Data types are divided into signed and unsigned. Fill in according to the information provided by the wheel speed signal. If the wheel speed signal does not specify whether it is signed or unsigned, it can also be determined based on the maximum and minimum values. If the minimum value includes a negative number, it is generally signed.

If using a DBC file for entry, fill in the Data ID according to the DBC file. The data start bit should be calculated using the formula n=N+7-（N%8）×2,where N is the start bit in the DBC file, and n is the value that should be entered on the webpage.

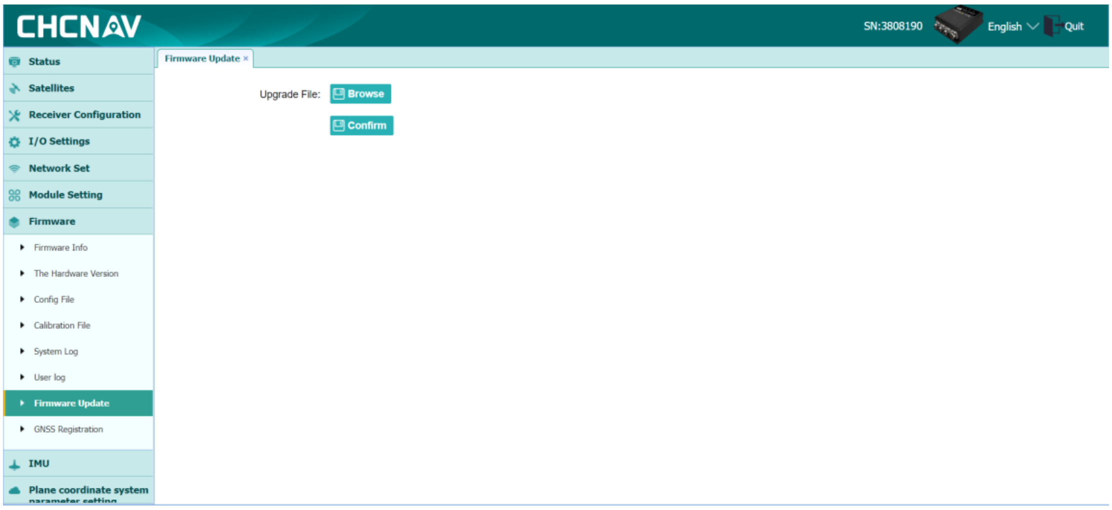
As:



Taking the above figure as an example, on the webpage, enter: Data ID: 291, Start Bit: 0, Data Length: 13, Proportional Factor:1÷0.05625=17.78, Fill in other options according to the provided information.

3.6 Firmware Update

Due to continuous updates and customization requirements from customers, firmware upgrades for the device may be necessary. To perform a firmware upgrade, access the device's web interface, click on the 'Firmware' option in the menu bar, select 'Firmware Upgrade,' and then click 'Browse' to choose the firmware file you wish to upgrade to. Click 'Confirm' to initiate the upgrade process. During the upgrade, the device's four indicator lights will flash in sequence and cycle through. Once the indicator lights return to normal, the upgrade is complete.



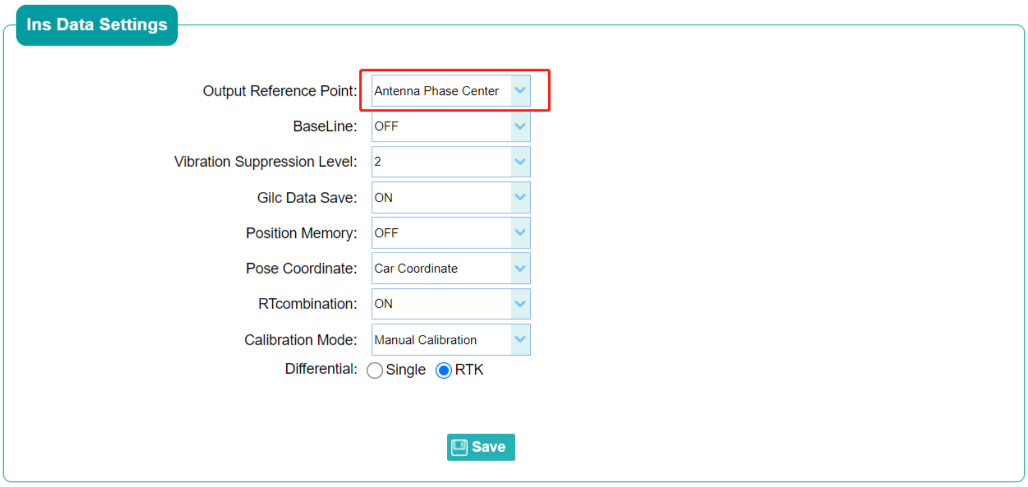
Notice: If the device has already been calibrated, depending on the specifics of the firmware version being upgraded, it may not be necessary to recalibrate after the firmware upgrade.

3.7 Data Post-processing

The CGI-830 device not only supports real-time output of integrated navigation data but also supports post-processing of data to achieve higher precision in positioning and attitude data. Correctly post-processed data can be used as ground real values. Detailed post-processing steps for the CGI-830 IE can be followed the relevant document's instructions.

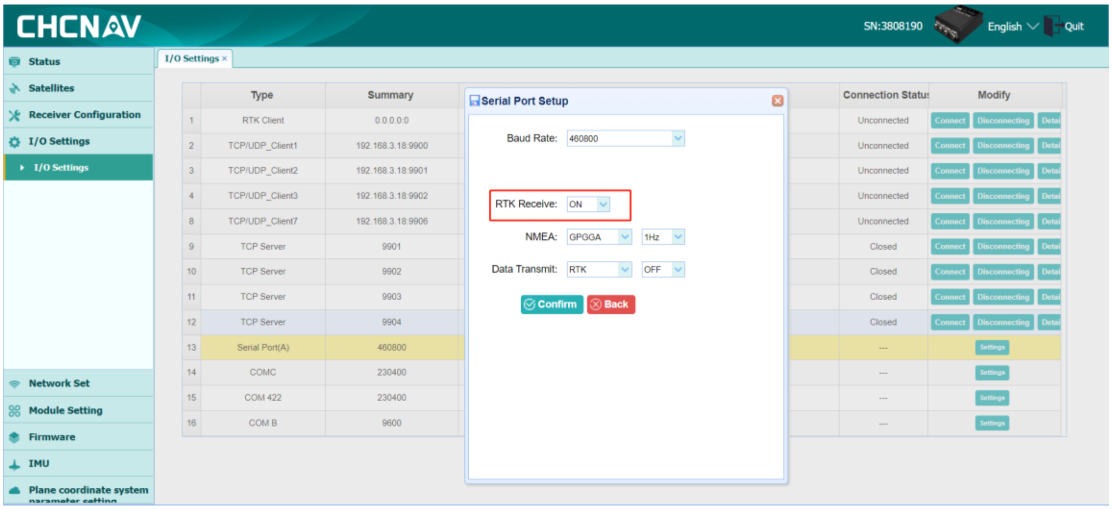
(1) Device Installation

The CGI-830 device must be rigidly connected to the vehicle. Use a power splitter to allow multiple devices under test to share a single positioning antenna. Set the positioning output location for both the CGI-830 device and the device for comparison at the phase center of the positioning antenna to control variables.



(2) Providing Differential Data to the Device

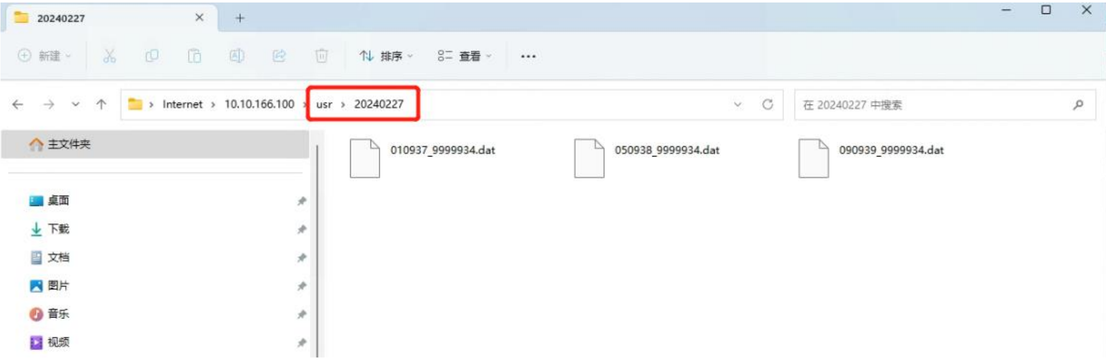
Transmit the same type of differential data to the CGI-830 device and the device requiring comparison. The Strsvr network transfer tool can be used to send differential data to the CGI-830 via Port C (with a baud rate of no less than 115200) to achieve a fixed solution state for the device.



(3) GNSS and IMU Data Output Setting

Configure the required data output for post-processing on the device's web page, as shown in the table below, including GNSS and IMU data. The output method can be selected as Ethernet, Port C, Port 422, or by using the "File Settings" to store data within the device.

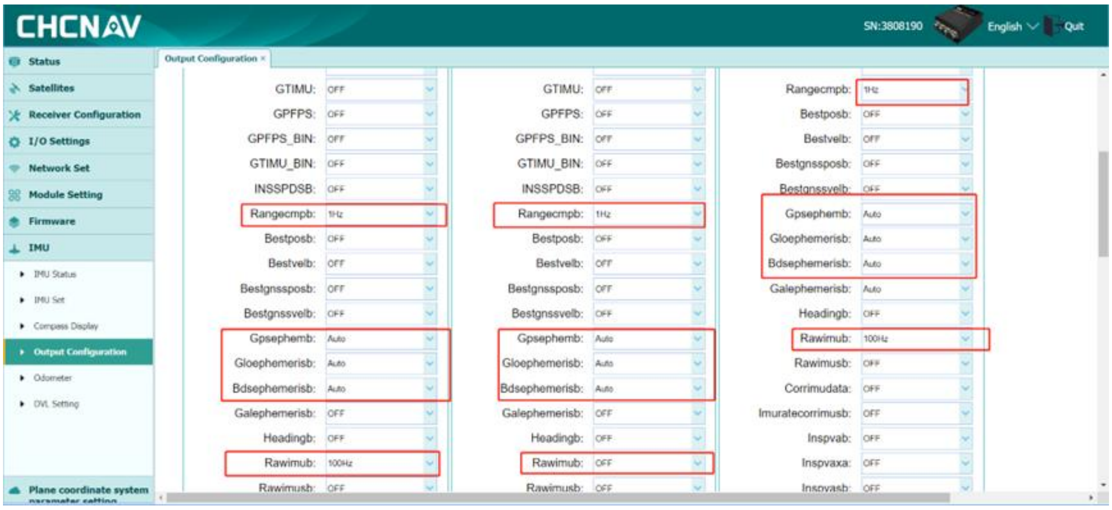
If using the "File Settings" method to store data, after completing the vehicle run, power off first, then power on again after one minute to copy the data files to obtain complete post-processed data. The method for copying data files is to connect to the device's WIFI, open the computer's file explorer, enter ftp://192.168.200.1 in the search box to access, go to the usr folder, where files are named by date. The *.dat files in the folder are the stored data. The data is named according to the GPS time when the device is powered on.



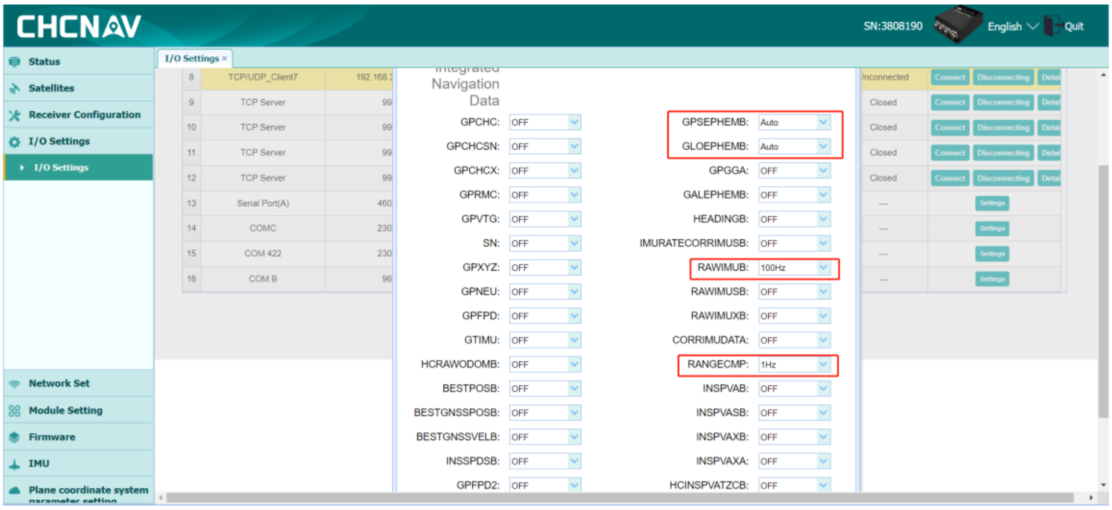
Content	Data type	Data format	Output frequency	Baud rate	Hardware interface
GNSS	GNSS original Observed data	RANGEB or RANGECMP	1Hz	460800	Ethernet, RS-232 C Serial Port, RS-422 Serial Port and Internal Storage Configuration
	GPS Ephemeris	RAWEPHEMB	60s/Auto		
	BDS Ephemeris	BDSEPHEMERISB	60s/Auto		
	GLONASS Ephemeris	GLOEPHEMERISB	60s/Auto		
IMU	INS raw data	RAWIMUB	100Hz		

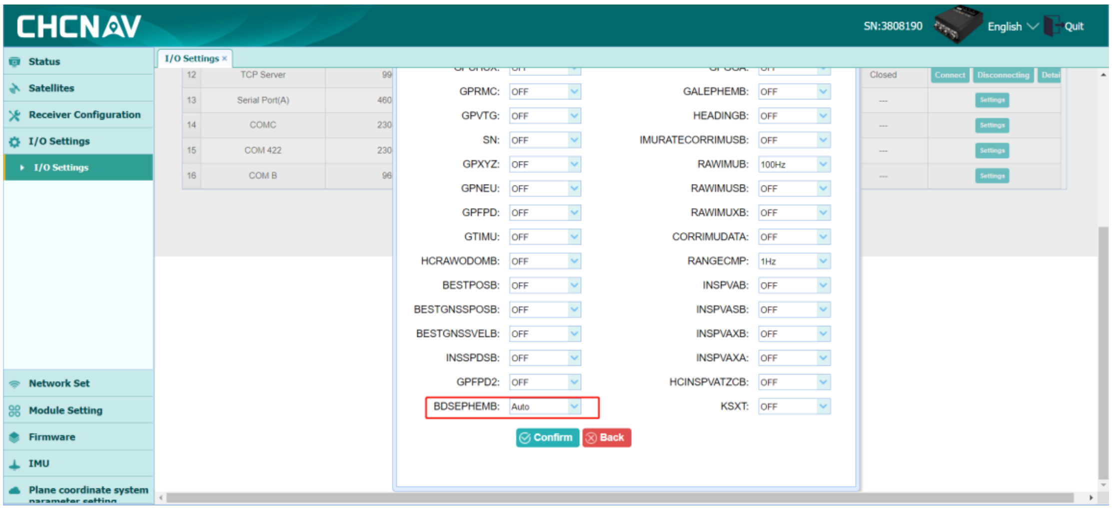
Choose any one of the four methods—Ethernet, Serial Port C, Serial Port 422, or File Settings—to output data.

Serial Port C, Serial Port 422, or File Settings for data output.



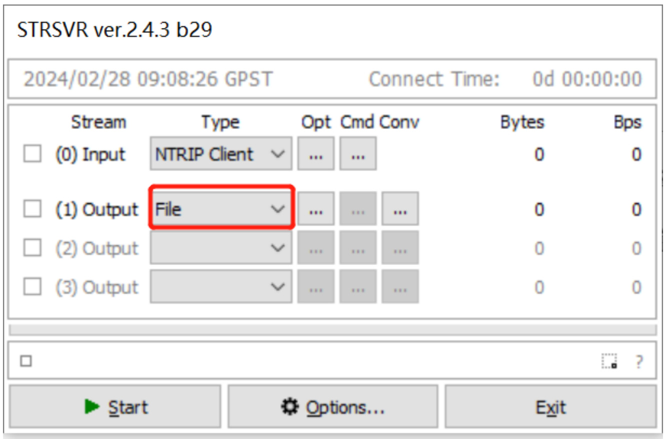
Ethernet for date output.





(4) Record Differential Data

Use the following STRSVR network transfer tool and operate according to the tool's user manual to record a separate set of differential data during the vehicle running period.



(5) Record the Necessary Parameters for Post-Processing

If you are using the IE software for post-processing, you will also need to accurately measure the arm length values X, Y, and Z from the IMU center to the phase center of the positioning antenna. It is recommended that the arm measurement error be controlled at the centimeter level, as these will be used in the parameter settings of the IE software post-processing.

To ensure driving safety, it is recommended to have two people accompany the vehicle during the running process, one person responsible for driving, and the other responsible for recording the scenes passed during the vehicle running and the start time.

4 Common Device Issue Analysis

Problem Description	Problem Cause Analysis	Solution
When logging into CORS, the source list cannot be obtained.	The device is unable to establish a connection or there is no network available.	Please check whether the SIM card and the 4G network antenna are properly connected, and verify if the SIM card has data available. Attempt to redial from the mobile network settings interface on the web page.
The output data appears as gibberish or consists entirely of dots	Incorrect baud rate settings	check the serial port baud rate in the web page's I/O settings interface and ensure it matches the baud rate set in the industrial PC or computer's data reception program.
The device is not searching for satellites.	The GNSS1 receiver antenna is not acquiring signals	Check whether the GNSS1 receiver interface is properly connected to the antenna and whether the antenna is placed in an open environment without sources of interference.
Device fix position but non-heading	The GNSS2 receiver antenna is not searching for satellites or has acquired only a few satellites.	Check whether the GNSS2 receiver interface is properly connected to the antenna and whether the antenna is placed in an open environment.
The data trajectory shows excessive deviation	The lever arm and angle parameters of the inertial navigation system were not set successfully or initialized properly.	To reconfigure the inertial navigation lever arm and angle parameters and perform initialization again.

GNSS 1 and 2 is opposite	The calibration indicates that the floating-point solution is non-directional, potentially due to the reversal of the dual antennas, resulting in a deviation between the actual heading angle and the dual-antenna heading angle.	Examine the heading angle on the web page receiver status interface and the heading angle on the inertial navigation status interface. Subtract the former from the latter to obtain a value. Compare this value with the configured value for the GNSS orientation baseline relative to the vehicle coordinate system. If the sign of the obtained value is opposite to that of the configured value, it indicates that the dual antennas are connected in reverse.
Device Issue Information Feedback Guidelines	We need you to copy the FTP logs from the device's internal storage and mark the time when the issue occurred. Additionally, please provide the current firmware version number of the device, as well as the configuration and calibration files.	To download the FTP logs, connect your computer to the device's Wi-Fi, then enter ftp://192.168.200.1 in the File Explorer to access the FTP server. The username and password are both 'ftp'. The logs are in the 'gilc-data' folder, named by date. Logging begins automatically upon device power-up, with the file timestamps set to the GPS time at each power cycle.

§ 15.19 Labeling requirements.
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

§ 15.21 Information to user.
Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

§ 15.105 Information to the user.
Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful
interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio
communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
-Reorient or relocate the receiving antenna.
-Increase the separation between the equipment and receiver.
-Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
-Consult the dealer or an experienced radio/TV technician for help.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator&your body.

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